AVIATION WEEK

OCT. 18, 1954

A McGRAW-HILL PUBLICATION

50 CENTS

Here it is, wearing the Honeywell label

Better engine control for the jet age

As ENGINES become more powerful, as planes fly faster and farther, the demand for a *better* engine control system has to be met.

The new Honeywell electro-mechanical control is such a system.

It makes it possible to accelerate a cold turbojet engine to full augmented thrust 30 to 45 seconds faster. The new fully automatic system takes much of the burden off the human pilot, and at the same time operates the engine at maximum efficiency under constantly changing conditions.

The new Honeywell engine control is a co-ordinated automatic electro-mechanical system. It utilizes the speed and sensitivity of electrical computers to position the mechanical control elements of the engine.

Because this new self-adjusting system *senses* conditions within the engine, it can give more accurate control and faster response than any purely mechanical system.

Weighing under 70 pounds, the new Honeywell system is a flexible system adaptable to any turbojet engine.

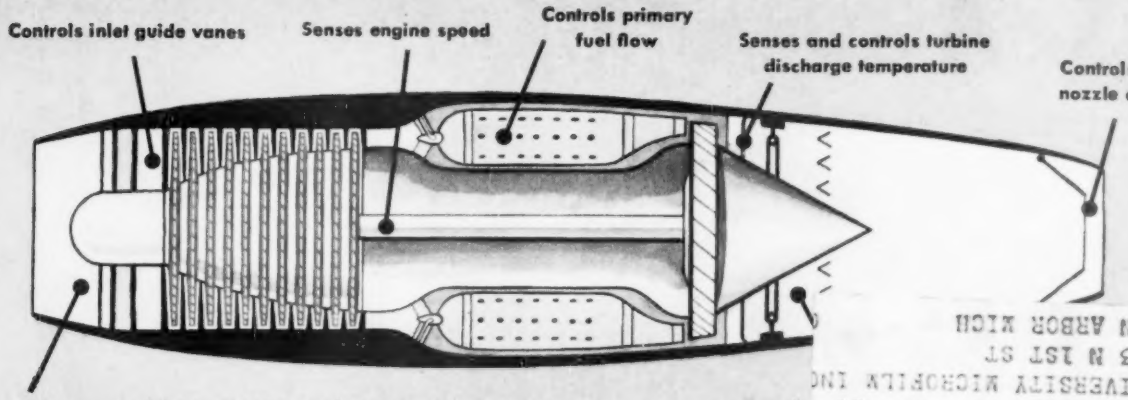
The new engine control system is another new development from Honeywell. There'll be more, for automatic control is so important to aviation's progress. And *automatic control* is Honeywell's business.

MINNEAPOLIS **Honeywell**

Aeronautical Division

2600 Ridgway Road, Minneapolis 13, Minn.

What the new Honeywell system does


Controls inlet guide vanes
Senses engine speed
Controls primary fuel flow
Senses and controls turbine discharge temperature
Controls jet nozzle area
Senses compressor inlet temperature and pressure

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meet the high standards required in the "incomparable Thunder-Craft."

Republic Aviation's F-84-F Thunderstreak establishes performance records among Air Force fighters and fighter-bomber types.

A new positive, simple design principle in the Kaylock nut provides the utmost in locking dependability

Lightest Strongest Smallest

Check these features:

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- Lowest Height
- Most Constant Locking Torque
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- Impossible to damage by cross-threading
- Only one part required for both 250° F. and 550° F.

Kaylock nuts are precision products, produced in full conformance with air force—navy specifications AN-N-5 and AN-N-10.

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Kaylock nuts are *lighter* than any other steel self-locking nut—and *as light as any aluminum nut.*

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RESEARCH KEEPS **B.F.Goodrich** FIRST IN RUBBER

Light shoe gives fighter more kick

REPUBLIC'S RF-84-F Thunderstreak is equipped with B. F. Goodrich brakes . . . brakes made lighter to help save weight for the supersonic fighter's guns and cameras.

A new kind of brake shoe assembly uses a light magnesium shoe with a bonded lining. This eliminates rivets, permits use of a lighter weight lining that can be worn down a greater percentage of its full thickness. The shoe is operated by a narrow cavity expander tube that gives high braking pressure with less fluid, and, of course, *less* weight. And because the pressure is applied outward to the brake lining without need for complicated parts, still more weight is saved.

Because the braking action applies equal pressure around a full circle, the load is distributed more evenly over the drum. Result: slower lining wear, less maintenance. And landings are safer and smoother with B. F. Goodrich brakes. They respond evenly to minimum pressure, yet are built to handle emergency overloads. They will not lock or grab. Strong retractor springs eliminate brake drag. Relining can be handled with a screw driver and pliers.

This B. F. Goodrich principle of full circle braking is used for all sizes of B. F. Goodrich brakes—from light private planes to huge bombers. It's one of many aviation developments that have come from B. F. Goodrich, leader in rubber research and engineering.

Other B. F. Goodrich products for aviation: tires and wheels, De-Icers, heated rubber, inflatable seals, Pressure Sealing Zippers, Avtrim, fuel and oil cells, Rivnuts, hose and other accessories. For more information write *The B. F. Goodrich Company, Aeronautical Sales, Akron, Ohio.*

B.F.Goodrich
FIRST IN RUBBER

Elastic properties of

AIRCORD

at your fingertips!

THIS NEW ROEBLING BOOKLET is the only practical and accurate manual ever offered designers and engineers on the physical characteristics of airplane control cord.

The first half of the booklet deals with the elastic properties of Roebling Aircord. It shows why the usual AE values of metallic cord and wire rope are not applicable to aeronautical service . . . gives elastic stretch tables . . . compares the elongation curves of bare and of Roebling Lock-Clad Aircord, and graphically describes the special design and service features of Lock-Clad.

The latter half of the booklet deals with the thermal properties of control cord . . . The coupon below will bring your free copy by return mail. John A. Roebling's Sons Corporation, Trenton 2, N. J.

A subsidiary of The Colorado Fuel & Iron Corp.

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Gentlemen: Kindly send me a copy of booklet, "Elastic and Thermal Properties of Roebling Aircord."

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Aviation Week

OCTOBER 18, 1954 VOL. 61, NO. 16

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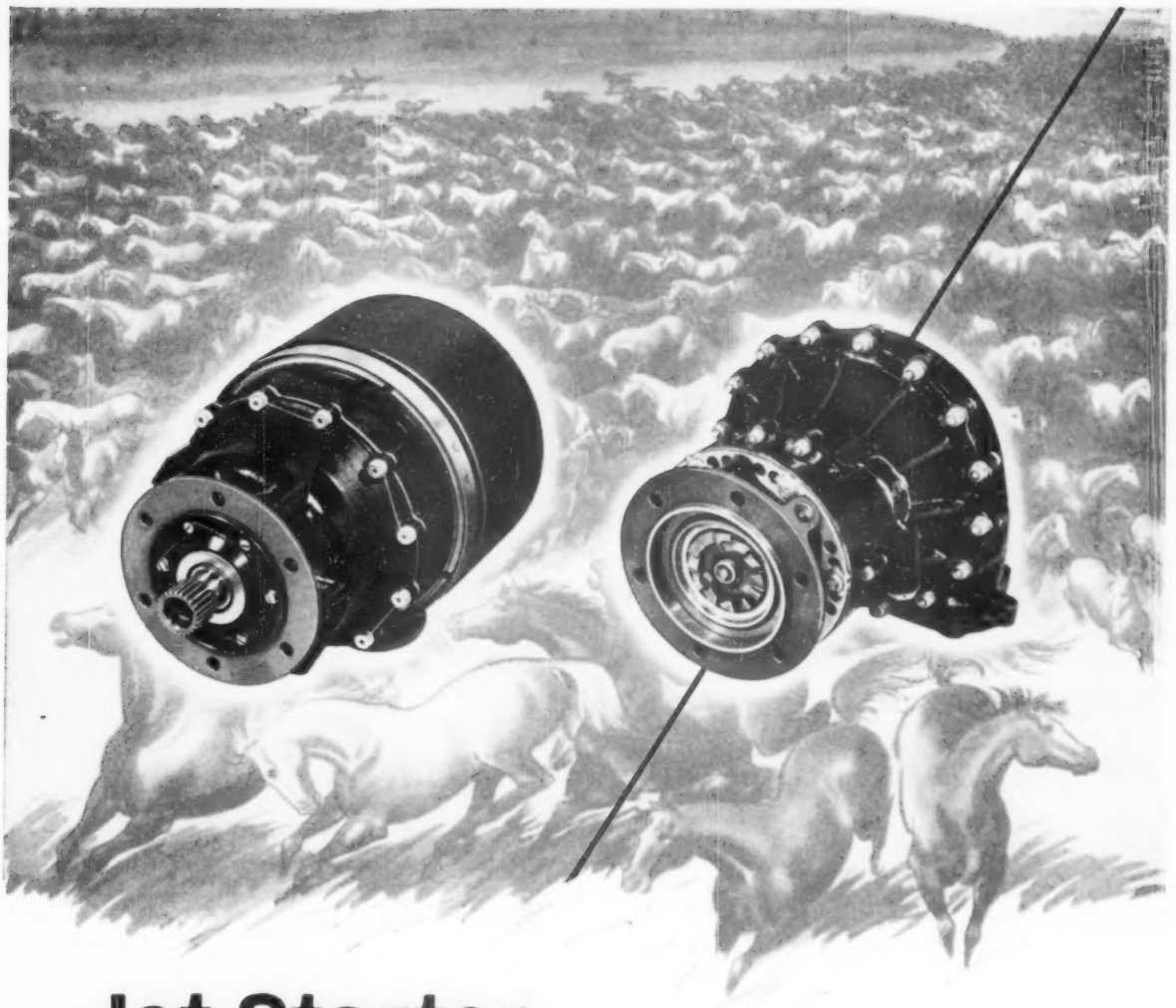

Jet Starter...

FOUR TIMES THE HORSEPOWER...LESS THAN TWICE THE WEIGHT!

At right (above) you see the *first* air turbine starter able to give continuous starts. This was pioneered by AiResearch in 1948. It weighed 17 lbs., produced 35 hp. and was used to start one of America's first turboprop engines: the Allison T-40.

But even then giant jet engines designed to produce 10,000 lbs. of thrust were on the drafting boards. Starting requirements were four times that of earlier jet engines. Could AiResearch create and manufacture such a starter, asked the Air Force.

AiResearch could – and did!

The answer is the unit at the left (above). Weighing only 27.5 lbs. and only slightly larger than the original model, it develops 140 hp. It is the only 140 hp. starter rugged enough to receive *unqualified* approval under Air Force qualification tests: MIL-E-5866A and MIL-E-5272!

Behind AiResearch starters are over 10,000 hours of operation in the laboratory and they have already produced over 100,000 successful starts in the field . . . evidence of the ability of AiResearch to deliver unusual power in small, light-weight packages.

AiResearch Manufacturing Company

A division of **THE GARRETT CORPORATION** *Los Angeles 45, California • Phoenix, Arizona*

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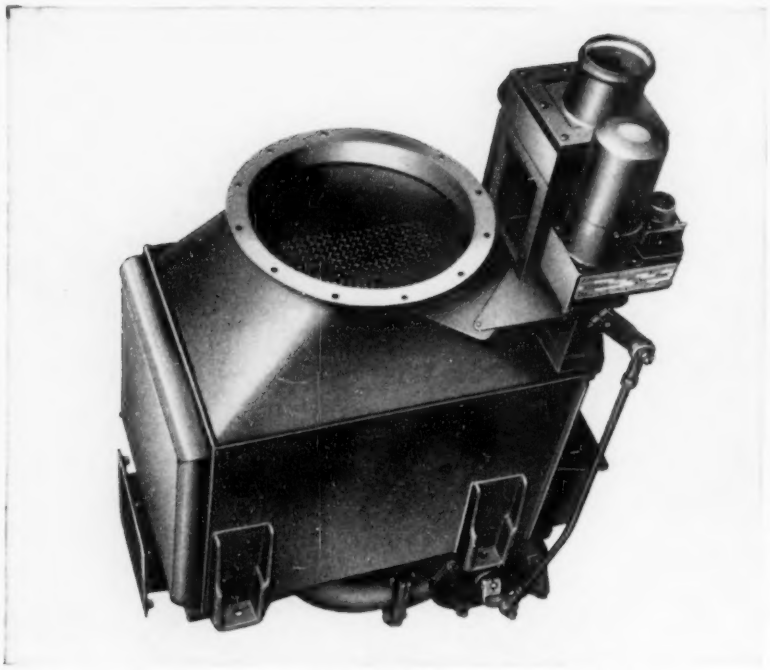
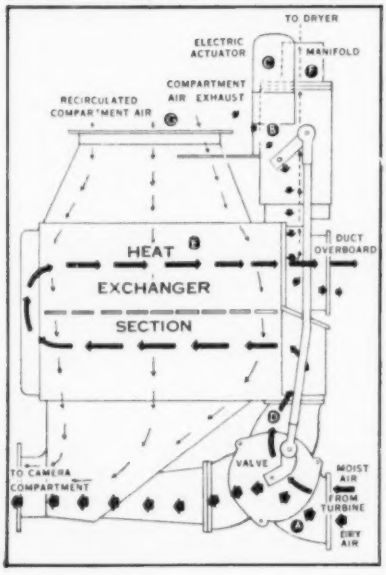


New, Compact Anti-Fogging Unit For The RF84F Camera Compartment

How to put adequate heat transfer capacity into a restricted space was the problem faced by Clifford engineers in developing this anti-fog unit for Republic's RF84F.

• ***Changes in altitude*** and other flight conditions cause variations in the moisture content of the air entering the camera compartment. Low humidity must be maintained to prevent condensation from forming on the glass camera ports. In addition, the compartment temperature must be kept at a certain minimum to insure proper functioning of the cameras.

• ***Key factor*** in the development of the anti-fog unit was Clifford's Wind Tunnel Laboratory — the largest, most completely equipped technical facility of its kind. Empirical data developed over many years of research in aircraft heat exchange problems plus the facilities to simulate accurately the conditions under which the unit must perform resulted in a quick, effective solution to the problem, (see below).



◀ During high altitude flight, ambient humidity is normally low and air for conditioning the camera compartment can be taken directly from the engine turbine bleed without danger of camera port fogging.

This air enters at A, passes through the valve and directly into the compartment distribution duct.(● ●)

After circulating through the compartment the air is removed through the upper port, B to the exhaust duct leading overboard. (● ●)

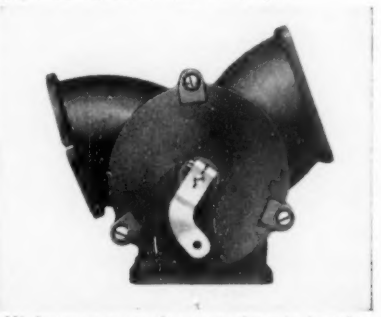
Under flight conditions in which turbine bleed air is humid, the anti-fog unit is switched on. The electric actuator C positions the diverting valve to direct the moist air up through one side of the heat exchanger E where it acts as a warming or cooling medium and then passes directly overboard.(⟶)

A small amount, however, is diverted upward through the manifold F, to a dryer. It then passes into the compartment to replenish air lost through leakage.(- - - ● - - - ●)At the same time, a blower mounted at G, recirculates the existing dry camera compartment air through the other side of the heat exchanger to be either warmed or cooled as compartment conditions require.(→ → → →)

Correct pressure is maintained in the compartment by a relief valve located in the upper port. B.

Republic's Thunderflash specifically designed as a virtual "flying camera", is capable of speeds "in excess of 650 mph" — and probably enough faster to slash in and out of enemy territory to get reconnaissance photos without engaging in combat. Air intake ducts are in wing roots so that nose can be devoted to cameras and electronic equipment. Clifford unit (left) keeps camera compartment humidity and temperature at levels that prevent condensation on glass ports.

Electric actuator designed by Clifford positions the valve for direct flow of turbine bleed air into the compartment or for diversion through the heat exchanger. It also positions the valve in upper port (B) to close off the manifold to the dryer.



Minimum pressure drop was an important requirement of the diverting valve. A special cylinder type design with careful configuration of passages and precise mating of surfaces resulted in low pressure losses.

► Clifford will gladly consult with you regarding your heat transfer problems and put its unique facilities to work developing the *right* solution to fit your requirements.

► Write: Clifford Manufacturing Company, 136 Grove Street, Waltham 54, Mass. Division of Standard Thomson Corporation.

7.4.15

Bellows And Bellows Devices

CLIFFORD MANUFACTURING CO. WALTHAM, MASS. DIVISION OF STANDARD THOMSON CORP.

Aircraft Heat Exchangers Valves Electronic Equipment

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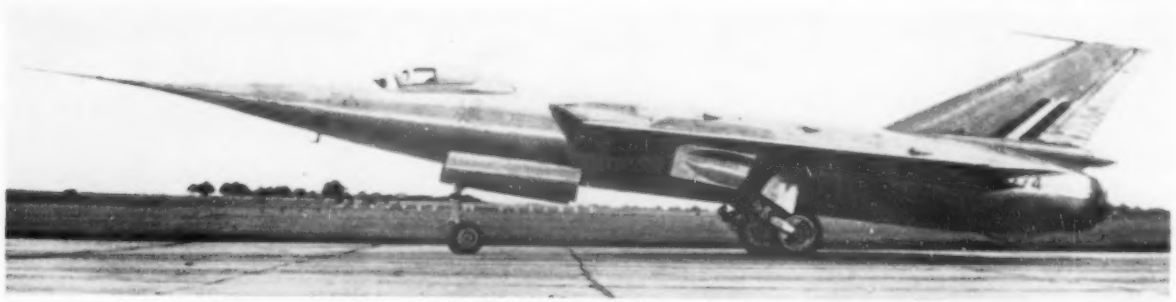


'Drawbridge Nose' Marks Supersonic British Jet

Britain's new supersonic Fairey Delta 2 shows off its "drawbridge" nose and exceptionally thin delta wing after the research jet's first flight Oct. 6. The elongated nose can be lowered in flight or on the ground for better visibility during takeoffs, landings or taxiing. The F.D. 2 is powered by a Rolls-Royce Avon turbojet powerplant. Position of nose in normal flight is as shown in this photo.

Domestic

George Welch, 36, senior engineering test pilot for North American Aviation, was killed last week after he bailed out of an F-100 Super Sabre during a high-altitude trial at Edwards AFB, Calif. Welch's parachute shredded during the bail out. He died on the way to the hospital. Welch was the first U.S. pilot to down a Japanese plane at Pearl Harbor. He destroyed 18 enemy planes during World War II.

Prototype 707 has completed the first phase of evaluation tests at Boeing Airplane Co.'s Seattle plant. Officials say the jet transport's longest flight was 5 hr. 5 min., spending considerable time at "high Mach numbers." Total flight time for the first phase: 43 hr. 27 min.

New pulsejet helicopter is being developed by Weber Aircraft Corp., Burbank, Calif., subsidiary of Weber Showcase & Fixture Co. In charge of the program: J. L. Velazquez, former project engineer for Piasecki Helicopter Corp.

First production C-123B, Fairchild Engine & Airplane Corp.'s Avitruc assault transport, is starting performance, stability and control tests at Edwards AFB, Calif. USAF took delivery on the first two production Avitrucs Oct. 6-7 at Fairchild's Hagerstown, Md., plant.

Last L-19 Bird Dog has rolled off Cessna Aircraft Co.'s assembly line at Wichita, bringing an end to more than four years of production of the Army reconnaissance plane. Total produced: 2,480.

Titanium research will be conducted by Battelle Institute under a new $1-million contract now being negotiated with the Defense Department. J. H. Garrett, chairman of the department's titanium committee, says the Cleveland organization will act as a trouble-shooter for problems in refining and fabrication.

DHC-3 Otter has been ordered by the U.S. Army from de Havilland Aircraft of Canada for tests as an air ambulance and front-line cargo plane.

United Auto Workers (CIO) has served notice on North American Aviation that it wants to modify the present labor contract. Negotiations must begin no later than Nov. 15, a month before the agreement expires. The talks will include NAA divisions at Los Angeles and Columbus, Ohio.

Republic Aviation Corp. has banned engine runups after 10 p.m. to reduce noise in the heavily populated area around its Farmingdale, N. Y., plant. Earlier this year, the company rearranged its traffic pattern to route takeoffs away from congested residential areas and out over Long Island Sound or the Atlantic.

RC-121 picket plane unit will be formed by USAF within the next year at Otis AFB, Mass. The "flying radar stations," converted Lockheed Super Constellations, now are being used by the Eighth Air Division in a combination training and operational national program at McClellan AFB, Calif.

Borg-Warner Corp. has extended its manufacturing operations to the West Coast by acquiring Weston Hydraulics, Ltd., of North Hollywood, Calif. Acquisition was through an exchange of stock. Weston manufactures hydraulic and pneumatic equipment for a large segment of the aircraft industry.

Vertical reference beacon, a converted surplus AF searchlight mounted on a chassis, has been set up by Port of New York Authority near La Guardia Airport to guide pilots over uninhabited Flushing Meadows when taking off from Runway 13 at night. Takeoff path is aimed at reducing aircraft noise during climbs.

National Airlines has purchased two Convair 340s from Pan American World Airways, increasing its 340 fleet to 12.

Financial

Beech Aircraft Corp., Wichita, has declared a 25-cent dividend on common stock, payable Oct. 28 to holders of record Oct. 18.

International

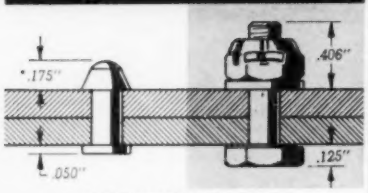
Turbojet research center is being constructed by A. V. Roe Canada at Toronto. The new center will deal with jet mechanics, material, instruments, aerodynamics and fuel systems.

Vickers Viscount 700D has been ordered by Norway's South American & Far East Air Transport (SAFE), is scheduled for delivery in March 1956.

F-86K Sabres will be delivered to the Norwegian Royal Air Force during the last quarter of 1955. The all-weather fighter is being built by North American Aviation and Italy's Fiat for North Atlantic Treaty Organization forces (AVIATION WEEK Sept. 20, p. 7).

British Overseas Airways Corp. has taken delivery on the first of six Boeing Stratocruisers purchased from United Air Lines as temporary replacements for its grounded jet Comet fleet (AVIATION WEEK Aug. 9, p. 53). The final Stratocruiser is scheduled to be delivered in early 1955.

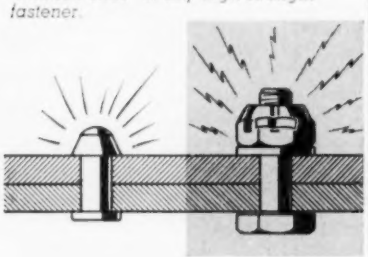
3 hi-shear FACTS THAT COUNT!



*PROTRUSION SHOWN FOR MAXIMUM GRIP CONDITION

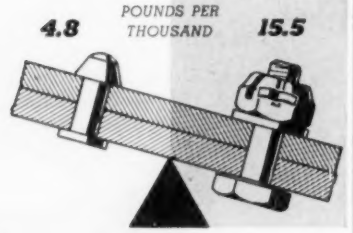
maximum protrusion

HI-SHEAR rivets have the smallest "headed ends" of any high strength fastener.



maximum smoothness

The smooth spherical rivet end eliminates chafing of adjacent fuel cells or other equipment. HI-SHEARS eliminate hazards in aircraft areas which are accessible to the flight or maintenance crews, passengers and cargo.



less weight

HI-SHEAR rivets are the lightest, standard high strength fasteners in the aircraft industry.

Installed fastener size and weight shown above are based on HI-SHEAR HS52P-6-5 pin and HS15-6 collar compared to AN3-5 bolt, AN310-3 nut and AN960-10 washer.

write for our booklet

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SUBMINIATURE RELAY—Plus!

Compact . . . Rugged . . . Light weight . . . 6 PDT arrangement

All these features are achieved by the use of an extremely efficient rotary motor, precisely built, with hydrogen annealed parts.

COMPACT—One inch diameter, with 1-5/16" long enclosure.

HEIGHT—above chassis, is only 1.216 inches.

RUGGED—Withstands operational shock of 50 G's and operational vibration of 5-500 C.P.S. at 10 G's. Altitude to 80,000 feet. Ambient temperature range of —65°C to +125°C.

LIGHT WEIGHT—Only 2.6 ounces (even with mountings interchangeable with larger relays of other manufacture).

Tests of production relays, under USAF supervision, have proven that this relay meets or exceeds the requirements of MIL-R-5757B.

Based on 1,000,000 operations, contacts are rated at 3 amperes, non-inductive, at 26.5 V.D.C. or 115 V.A.C., 60 to 400 CPS.

Coil resistance values range from 6 ohms to 14,000 ohms. Relay pictured above has 1-9/16" mounting centers but can be supplied with other mounting styles requiring less chassis space.

Other standard contact arrangements are 2 PDT, 3 PDT and 4 PDT. All are available in the plug-in construction.

Fill in coupon for catalog.

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Please send data sheets on your subminiature relays.

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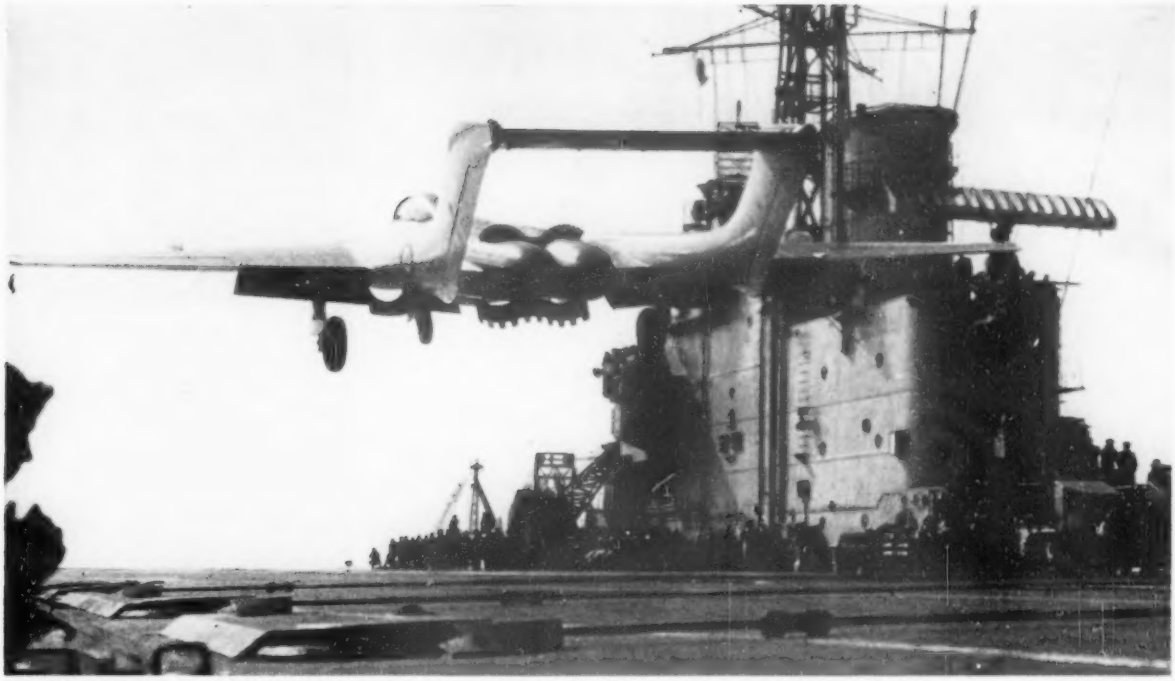
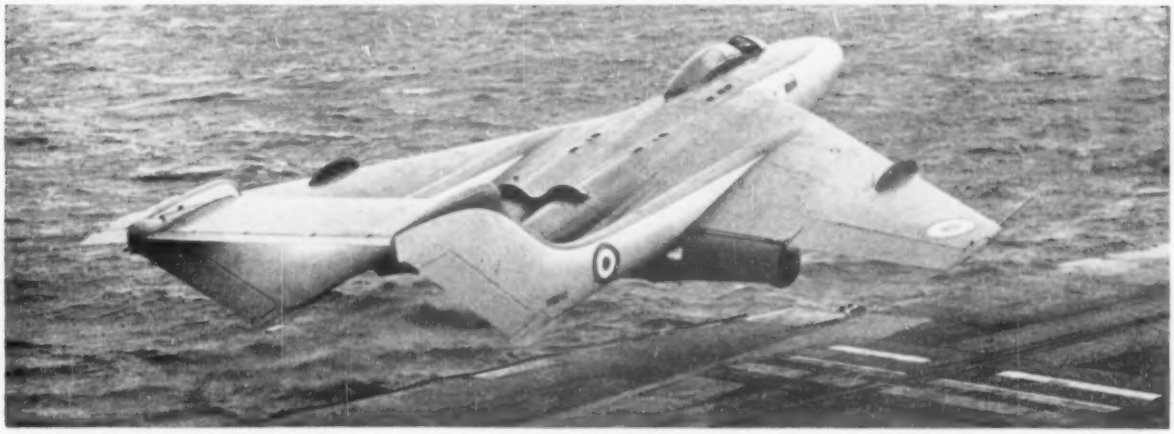


OFF HMS ALBION goes DH-110 after brief touchdown, its flaps lowered and serrated air brakes open above and below twin tailpipes.

DH-110 Passes First Carrier Tests

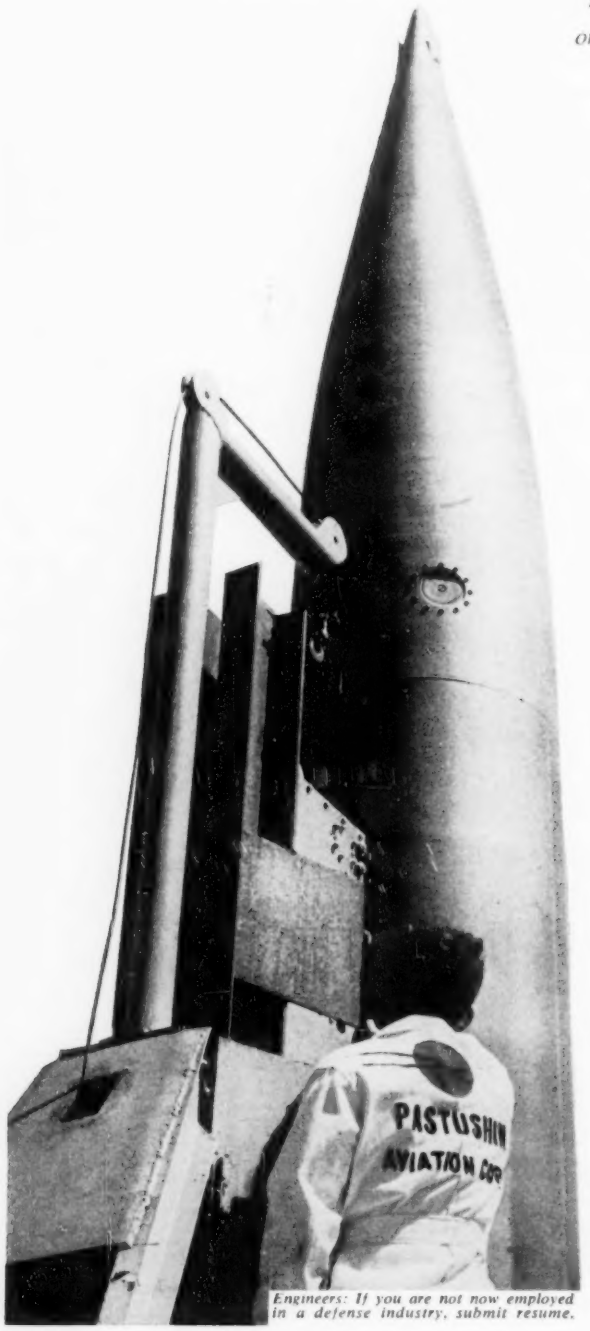
GUIDED by new mirror-and-light landing aid (off left wingtip in right photo), DH-110 comes in for touch-and-go landing on carrier during tests.



TAKING OFF OVER CANTED SECTION of carrier's deck, prototype DH-110 shows its large wing area. Operational version of this plane, the largest and heaviest to fly from a British carrier, will have wings that fold, an arrestor hook and catapult gear.

PROVED
on the firing line

Thousands of "firings" on Pastushin Aviation's outdoor Firing Test Stand testify to the operational efficiency of the Pastushin force ejection system consisting of ejection mechanisms and external stores.



Engineers: If you are not now employed in a defense industry, submit resume.

Pastushin assures complete jettisonable reliability by stringent tests on its own equipment. Static, slosh and vibration and force ejection tests qualify all external tanks; environmental, static and firing tests prove out all ejection mechanisms. Finally, air-drops furnish conclusive proof of the system's reliability in forcibly ejecting bombs, jettisonable fuel tanks and other external stores. Ready now to your special requirements.

RESEARCH • DESIGN • DEVELOPMENT • PRODUCTION

PASTUSHIN

AVIATION CORP. • Los Angeles, Calif.

WHO'S WHERE

In the Front Office

Jose Lopez Vilaboy has been elected president of Compania Cubana de Aviation, succeeding **Sergio I. Clark,** who resigned.

Gerald J. Mills is president of Mattel Engineering Co., new avionic and airframe component subsidiary of Mattel, Inc., Los Angeles. Other officers: **Elliot Handler,** executive vice president; **Ruth Handler,** secretary-treasurer.

Alexander G. Hardy has become vice president in charge of National Airlines' Washington, D. C., executive offices. **Capt. Watson A. Burton** (USCG Ret.) is new assistant to the president of NAL. Elected directors: **Daniel R. Topping,** co-owner of the New York Yankees; **Edwin C. McDonald,** vice president of Metropolitan Life Insurance Co.

Herbert A. Munter has taken a leave of absence as executive vice president of West Coast Airlines.

John M. Dolan has been appointed vice president-sales of Solar Aircraft Co., San Diego. **Capt. Charles Antoniak** (USN Ret.) has joined Solar as engineering consultant on powerplants.

Changes

Forrest F. Hinkley is new general manager of Aero-Coupling Corp., Burbank, Calif., subsidiary of Aeroquip Corp.

Christopher Clarkson, former civil air attache at the British embassy in Washington, D. C., has become U. S. representative for Vickers-Armstrongs, Ltd., with headquarters in New York.

Otto E. Kirchner, former operational engineering director for American Airlines, has joined Boeing Airplane Co., Seattle, as an engineering supervisor of commercial aircraft studies.

Don Black has moved up to assistant director of public relations for Douglas Aircraft Co., Santa Monica, Calif. Other changes: **Hu Gagos,** public relations manager; **C. G. Miller,** special events coordinator; **Larry Vitsky,** public relations manager for the Santa Monica (Calif.) Division.

Honors and Elections

Ernest G. McCauley, pioneer inventor, developer and manufacturer of aircraft propellers, has received a special citation of appreciation from the Air Force for "outstanding service" to USAF from 1918 to 1950. Special mention is made of his invention of the Hydro-Controllable Pitch Propeller. McCauley also developed the solid steel props used on Stearman trainers and more recently the Met-L-Prop for lightplanes.

Leland C. Launer, executive vice president of Fletcher Aviation Corp., has been elected president and board chairman of the Fletcher Foundation for the next two years.

Robert L. Sink, assistant director of engineering for Consolidated Engineering Corp., has become chairman of the Institute of Radio Engineers' professional group on instrumentation.

INDUSTRY OBSERVER

► NATO has begun evaluation of the five competitors in its lightweight fighter-bomber and interceptor competition. In addition to the Folland Gnat, whose prototype Midge made its debut at the 1954 Farnborough show, the NATO evaluators have four design studies from three countries to consider. They are: Dassault and Breguet of France; Fiat of Italy with a design based on its jet trainer, and Avro of England with a delta design based on its Model 707 research planes.

► Martin's multi-jet XP6M-1 Seamaster mine-laying seaplane should be ready for first flight next spring. First version of the highspeed seaplane, originally scheduled to be powered by four Wright J67 split-compressor turbojets, now will be fitted with four Allison J71s rated at 9,500 lb. static thrust plus afterburner. Martin is buying the afterburner versions of the J71 directly from Allison.

► Reconnaissance versions of Boeing B-52 Stratofortress will be equipped with two interchangeable types of pressurized pods to fit in the bomb-bay. One will be a photographic pod containing aerial cameras and two technicians. The other will be for electronic countermeasures and will house a crew of six plus equipment. On bomber versions of the B-52, only the cockpit and tail gunner's compartment are pressurized.

► Army Ordnance is asking for production bids on the LaCrosse tactical missile originally developed under Marine Corps auspices. This subsonic, rocket-powered glider missile was designed for the same type missions as the Douglas Honest John, but it now is being equipped for all-weather operations

► Philco is revealed as at least one of the contractors involved in the Navy's air-to-air missile Sidewinder, according to the Department of Commerce government contract summary.

► Current discussions between Convair and the Napier Division of English Electric on an Eland-powered 340 Convair-Liner are purely exploratory. Any action hinges on Convair's choice of a turboprop for future development of the 340 airframe. The 3,000-eshp. Eland turboprop would fit requirements for some military versions of the 340, but current Convair thinking is leaning toward use of four advanced versions of the Rolls-Royce Dart turboprop powerplant for future commercial development of the 340.

► Bell VTO has been flying under limited operating conditions for about six months with test pilot Dave Howe at the controls. The Bell VTO is a private venture supported militarily only by USAF bailment of Fairchild J44 turbojets. Two J44s are mounted on the fuselage just under the wing. They are tilted to provide directional control.

► Second and fully armed version of the Lockheed XF-104 day superiority fighter has made several flights and soon will go into an armament ground testing program. First XF-104 is nearing completion of Phase 2 flight testing at Edwards AFB.

► Douglas is finishing a demonstrator version of the DC-7 transport at its Santa Monica plant. Plane will be used for flight testing new equipment and demonstrations for prospective customers.

► Second Lockheed YC-130 turboprop air freighter is nearing rollout at the Burbank plant. First prototype has logged about 50 hr. flight time, nearly half of which has been in short hops combined with taxi tests. On one test C-130 took off, leveled off at an altitude of 10 ft., then landed and rolled to a stop without use of brakes in less than 3,500 ft.

► Navy gradually is ungrounding its Grumman F9F-7s and F9F-4s as fixes are completed on the fuel nozzle support for the Allison J33-A-16 turbojets. Grounding was a precautionary measure after fatigue cracks were detected in support (AVIATION WEEK Sept. 13, p. 11).

Washington Roundup

Sonic Boom Problem

USAF is expecting intensification of its community noise problem now that North American F-100 Super Sabres are being delivered for squadron service. Recent experience of Maj. Gen. Al Boyd, famous USAF test pilot and commander of Wright Air Development Center, gave a preview of what might happen.

Gen. Boyd was test flying an F-100 at an altitude over 40,000 ft. when he went past Mach 1 in level flight. These sonic booms did not reach the ground but when Gen. Boyd dropped the F-100 nose slightly booms hit the 5 p.m. rush-hour traffic and set off the fire alarm system at the Dayton State Hospital for the mentally ill. Five fire engines, two fire chiefs' cars and two police squad cars alerted by the fire alarm sped toward the hospital through the traffic jams, creating more excitement than any local event since the 1913 flood.

Development Race

Donald A. Quarles, Assistant Defense Secretary for Research and Development, continues to insist that the United States' lead over Russia in scientific developments is not "comfortable."

His latest assessment of the U. S. Soviet development race came less than four months after a conflict in views turned up between Quarles and Defense Secretary Charles E. Wilson during a meeting of defense leaders at Quantico, Va.

At that time, Quarles said: "Our technical position vis-a-vis the Soviets is less favorable than it was a year ago."

Wilson, at the same time, said that the U. S. still has an overall lead of two to three years over the Soviet Union in weapons technology.

Quarles last week said: "While it is true that in every major postwar event of great significance in military science the United States has been out ahead of the Soviet Union, we are forced to conclude that we no longer have a comfortable margin and that the technological advantage we were counting on to offset their great numerical superiority can no longer be taken for granted."

Watch the Kuriles

While shooting at Quemoy Island and the diplomatic maneuvering in Indo-China have turned the spotlight on the danger spots of Southeast Asia, top U. S. military leaders are still most concerned about the Russian buildup of strength in the maritime provinces of Siberia and the Kurile Islands that outflank Japan from the north.

Russians have far more air and naval strength in these areas than required for defensive purposes. Red air strength in this area is in striking distance of most USAF bases in Japan. Meanwhile, there are unconfirmed reports that the Russians have moved several squadrons of new high-altitude interceptors to eastern Siberia as a threat to USAF reconnaissance and patrol bombers operating over the northern Pacific.

Nonstop Schedule Trouble

Civil Aeronautics Board is putting the pressure on American, United and Trans World Airlines to make the scheduling on their nonstop transcontinental service more realistic.

Last summer, CAB, acting on an informal complaint from the Air Line Pilots Assn., did an analysis on the nonstop schedules of the three carriers. All three were found unrealistic because of the small percentage of on-time operations. The Board had decided that to be realistic, a carrier's published schedule should be capable of being met at least 75% of the time.

American, United and TWA were advised in a letter that filed and published schedules should be adjusted so they are capable of being met. The carriers were asked to answer within five days, outlining what action would be taken. They also were warned that continued publication of unrealistic schedules would result in institution of enforcement action.

It is reported that all three of the carriers were unhappy about the letter, that two of them have asked for an opportunity to argue the case. Whether or not formal proceedings will be instituted remains to be seen.

New Feeder Mail Rate?

Civil Aeronautics Board may propose extending its new formula for determining service mail pay to the 14 local service lines, as well as the 13 domestic trunklines. Providing for payments for mail enplanings, by weight, as well as payments for in-transit hauls, this generally favors the shorthaul trunklines over the longhaul trunks.

Effect of application of the new formula on local service lines is questionable. Although their hauls are short and their enplanings frequent, the "weight" of their enplanings is light. It is to "weight" that the formula would gear payments.

Hiring and Firing

Two major aircraft companies with similar problems last week created a flurry in the aviation employment curves. Piasecki Helicopter Corp. said it is dismissing between 450 and 600 production workers in a second mass layoff attributed to difficulties with the H-21 Work Horse helicopter. Republic Aviation Corp. said it is rehiring from 700 to 1,000 employes to resume full production of the F-84F Thunderstreak.

Both plants are plagued with what Defense Secretary Wilson calls "cripples in the yard." Republic, working hard on modification of the F-84s at Farmingdale, has plans to increase production as the fighters are moved out by the Air Force. The pool "is being reduced satisfactorily," Republic president Mundy I. Peale said following a visit to the Republic plant by Secretary Wilson and a party of top-rank aides (AVIATION WEEK Oct. 4, p. 9).

At Piasecki's factory in Morton, Pa., the company said a new layoff was made necessary by an Air Force order to reduce the delivery rate of H-21s "to allow the incorporation of technical improvements . . . to reduce the vibration level to a new low." USAF sources said modifications are needed on existing H-21s to bring vibration "to an acceptable level."

The Work Horse has been ungrounded since it was ordered out of the air last spring and several hundred employes laid off (AVIATION WEEK June 14, p. 15). It is used on limited operations in the Air Rescue Service and Air Training Command. Pentagon spokesmen for both USAF and Army say initial blade problem seems to have been solved and progress is being made on excessive vibration, but both services have been forced to defer H-21 programs for a few months.

—Washington staff

AVIATION WEEK VOL. 61, NO. 16
OCTOBER 18, 1954

Military Experts Open Missiles Probe

- **Top-level Defense Department investigation expected to have profound effect on future developments.**
- **Service spokesmen see situation much improved over last spring, when senators called it 'disorganized.'**

By Claude Witze

Defense Department has started the top-level investigation of its guided missile program demanded last spring when the Senate Committee on Appropriations found evidence of "a disorganized situation."

Missile experts of all branches of the armed forces expect the new report will have a profound effect on the nature and speed of future missile developments. The Senate committee set a deadline of Jan. 15 for delivery of the findings.

▶ **Committee Members**—Heading the new committee, appointed by Defense Secretary Charles E. Wilson, is Frank B. Newbury, Assistant Secretary of Defense for Applications Engineering. Other members are Adm. Arthur W. Radford, chairman of the Joint Chiefs of Staff; W. J. McNeil, Assistant Secretary of Defense and controller of the Defense Department, and Donald A. Quarles, Assistant Secretary of Defense for Research and Development.

In addition, each of the armed forces has designated a representative to work with the committee and provide information when requested. These assignments have been given to Maj. Gen. S. R. Brentnall, Air Force assistant chief of staff for guided missiles; Capt. F. A. McKee, assistant director of the Guided Missiles Division of the Office of the Chief of Naval Operations, and Maj. Gen. Harry Roper, deputy assistant chief of staff, G-3, operations, USA.

▶ **Offsetting Confusion**—Service spokesmen last week appeared confident that the new probe would uncover a picture offsetting at least to some degree the confusion detected by the Senate committee in its hearings.

They cite a forthcoming agreement to define more clearly the roles and missions of Army, Navy and Air Force. This review, described more than a year ago as a "Key West conference type" of agreement to result from a review by the Joint Chiefs of Staff, now is understood to be awaiting approval of the top Defense Department command (AVIATION WEEK June 1, 1953, p. 13).

First conference assigning defense roles was held in 1948 at Key West, Fla.

▶ **Missile Muddle**—The new definition of roles and missions is designed to prevent future overlapping or conflict between branches of the armed forces in missile development. It has been common knowledge in aircraft industry and military circles that competition and duplication of effort have existed in the overall missile program.

The importance of this has been accentuated in recent months by reports of Russian technological progress that have not been missed by sharp eyes in Congress (AVIATION WEEK Aug. 2, p. 13).

"Service witnesses," the Senate Appropriations Committee said, "in almost every instance, while lauding the characteristics of the missiles under production for their particular service, had a tendency to belittle the programs of the sister services."

Pentagon observers believe the new agreement on roles and missions—delineating the areas in which the Army, Navy and Air Force must operate—will attempt to bring an end to the missile muddle.

▶ **'Chef's Hat'**—Due to internal pressure, as well as concern on Capitol Hill, the services already have started improvement of their missile programs. A good example of this is found in the Air Force, where a new office, the Assistant Chief of Staff for Guided Missiles, was set up last April.

Its first chief, called in from the Far East Air Forces a little over a year ago, is Maj. Gen. S. R. Brentnall, named as USAF representative to the new Defense Department inquiry.

Brentnall says he was picked for his staff post with the admonition: "You don't like burned potatoes, so here's the chef's hat." During his first four months in the Pentagon, Brentnall studied the guided missile problem,

BOAC Talks Turboprop DC-7

British Overseas Airways Corp. is negotiating with Douglas Aircraft Co. for the purchase of turboprop DC-7D transports.

The BOAC negotiations confirm Aviation Week's prediction (Oct. 4, p. 79) that international competition would force the British trans-Atlantic airline to buy Douglas DC-7s.

A BOAC deal with Douglas will require official approval of the British government and is certain to raise a political storm in Parliament as it would deal a heavy blow to the already battered hopes of British aircraft manufacturers in the international market.

The DC-7D would be powered by Rolls-Royce RB-109 turboprops now under development and aiming at 4,000 eshp.

Both BOAC and Douglas admitted last week that negotiations for the DC-7D are under way but said no firm contract had been signed yet. The admission followed a visit of a Rolls-Royce delegation headed by Lord Hives, managing director of the British firm, to Douglas and other West Coast transport manufacturers.

BOAC said the DC-7D would be available by 1958 or 1959, but this seems doubtful since the Rolls twin-spool turboprop is in an early stage of development and has not yet run as a complete engine on the test stand. British circles regard 1960 as the earliest possible delivery date for the RB-109.

The DC-7D would be the same airframe as the DC-7C, with substitution of the Rolls turboprop for the Wright Turbo Compound piston engines as the only major change. Douglas has another thin-wing version of the DC-7 series in the mill, but it hardly would be ready before 1960. It is aimed at a 425-mph. cruising speed. The DC-7D is expected to cruise at 380 mph. over a range of 4,300 mi. with a 15,000-lb. payload.

The negotiations with Douglas were interpreted as evidence that Sir Miles Thomas, BOAC chairman, does not expect an early return of the de Havilland Comets to transport service and is hedging against the larger order already placed for the turboprop Bristol Britannia.

then came up last December with a plan for more coordination in the USAF effort.

It is possible that his suggestions would have been ignored except for the fact that another report came along in a few weeks giving top-level support to his thesis. This was submitted by a committee headed by Trevor Gardner, Special Assistant for Research and Development in USAF (AVIATION WEEK Mar. 15, p. 78).

The Gardner committee toured the nation's missile plants to work on its primary problem of uncovering duplication in the Air Force missile program. This it did, with the result that Gen. Brentnall, the man who already had spotted "burned potatoes," was named Assistant Chief of Staff for Guided Missiles.

Gen. Brentnall's staff has these responsibilities:

- To coordinate staff efforts and approve the overall planning and implementation of guided missile programs.
- To provide advice and guidance to Air Staff offices on guided missile matters.
- To provide a central point of contact in USAF headquarters on guided missile matters.

▶ **Coordinated Efforts**—His staff has responsibility for proper coordination of the roles played by development, materiel, operations, personnel and even the comptroller when the Air Force is using a missile anywhere in the world.

The effort to set up an office of Assistant Chief of Staff for Guided Missiles was going on even while the Senate Appropriations Committee was conducting hearings. The overall Defense Department missile program, now involving purchases and obligational authority of nearly $3 billion, is large enough to draw critical attention from Congress.

▶ **Signs of Rivalry**—Spokesmen for all branches of the armed forces are quick to deny there are any interservice "fights" over missile policy, although industry and legislative critics have pointed to signs of rivalry.

The military recognize some of these conflicts, as in the case of the Air Force Matador and the Navy's Regulus and other examples in anti-aircraft and air-to-ground projects.

In other cases, the Pentagon says, there is an explanation of what may look to a Senate committee like unnecessary duplication. An example of this is the air-to-air missile, where the Navy and Air Force are shooting from different types of planes at different kinds of targets.

▶ **Spur or Delay**—The Newbury committee report will be reviewed by Secretary Wilson before it goes to the Senate Committee on Appropriations.

One Pentagon observer says: "If they view with alarm, the budget requests will be cut. If they find the house in order but the program moving too slowly in view of reported Russian progress, the missile program will move ahead fast."

New AF Contracts Top $1 Billion

Production orders go for B-58, F-104 and KC-135, as B-52 and F-100 programs are increased sharply.

Air Force, in the six-week period since Sept. 1, has awarded new contracts totaling more than $1,037 million.

In sharp contrast to the pace of USAF buying in the previous year and a quarter, the contracts for new production reported last week by Secretary Harold E. Talbott included:

- **Convair B-58 Hustler,** supersonic bomber (AVIATION WEEK May 24, p. 13).
- **Lockheed F-104,** lightweight day superiority fighter (AVIATION WEEK July 12, p. 15; Aug. 9, p. 21).
- **Boeing KC-135,** jet tanker version of the Boeing 707 (AVIATION WEEK Aug. 2, p. 63; Aug. 9, p. 30).

Talbott also disclosed USAF has increased its orders and accelerated production of the Boeing B-52 jet bomber, in addition to ordering increased numbers of North American F-100 fighters.

▶ **Increased Base**—"These contract awards initiated under the fiscal '55 buying program reflect a significant increase in the aircraft production base above that previously considered possible," he said.

"This broadened base includes the jet tanker production at Renton, Wash., the second source production of the F-100 fighter at Columbus, Ohio, and the acceleration of B-52 bomber production at the second source in Wichita, Kan."

The B-58 will be made by Convair at Ft. Worth, Tex., and the F-104 by Lockheed at Burbank, Calif.

The order for additional B-52s brought two new contracts to Boeing, one for follow-on production at Seattle and another for increased output at Wichita.

▶ **Aircraft Orders**—Additional USAF contracts signed since July 1 and formally announced last week included:

- Sikorsky Division, United Aircraft Corp., Bridgeport, Conn., H-37 (S-56) helicopter for the Army. This is the first Sikorsky twin-engine helicopter, initially ordered by the U. S. Marines.
- Lockheed Aircraft Corp., Marietta, Ga., C-130 turboprop transport.
- Convair, San Diego, Cal., additional C-131 transports.
- Beech Aircraft Co., Wichita, T-34 trainer.

▶ **Engine Orders**—Talbott said engine contracts totaling $73 million have been let since July 1 for the J57 jet engine, of which $50 million was awarded to Pratt & Whitney Aircraft, Hartford, Conn., and $22 million to Ford Co. at their Chicago plant.

In addition, the summary included a $34-million contract to the Allison Division of General Motors Corp., Indianapolis, for J71 jet engines. General Electric Corp., Evendale, Ohio, received an order for $21 million in J73 engines. Allison also received $35-million order for T56 turboprops for the C-130.

An order also has been placed with P&WA for the YJ75 jet engine, a new split-compressor turbojet rated at about 15,000 lb. thrust.

▶ **Obligation Slump**—Talbott's listing of contract awards, made while Defense Department purchasing policies are under heavy fire in the political campaign, came out as published figures on Air Force and Navy obligations showed that buying was in a slump.

Obligations of both USAF and Navy dropped sharply in July, and again in August, according to official figures.

- USAF obligations fell from $794 million in June to $130 million in July, and to $33 million in August.
- Navy obligations dropped from $295 million in June to $102 million in July, and to $44 million in August.

▶ **Procurement Gains**—After lagging for a year, the net procurement obligations of both services gained sharply in June. Administration spokesmen declared this was the turning point for an acceleration in the obligation rate.

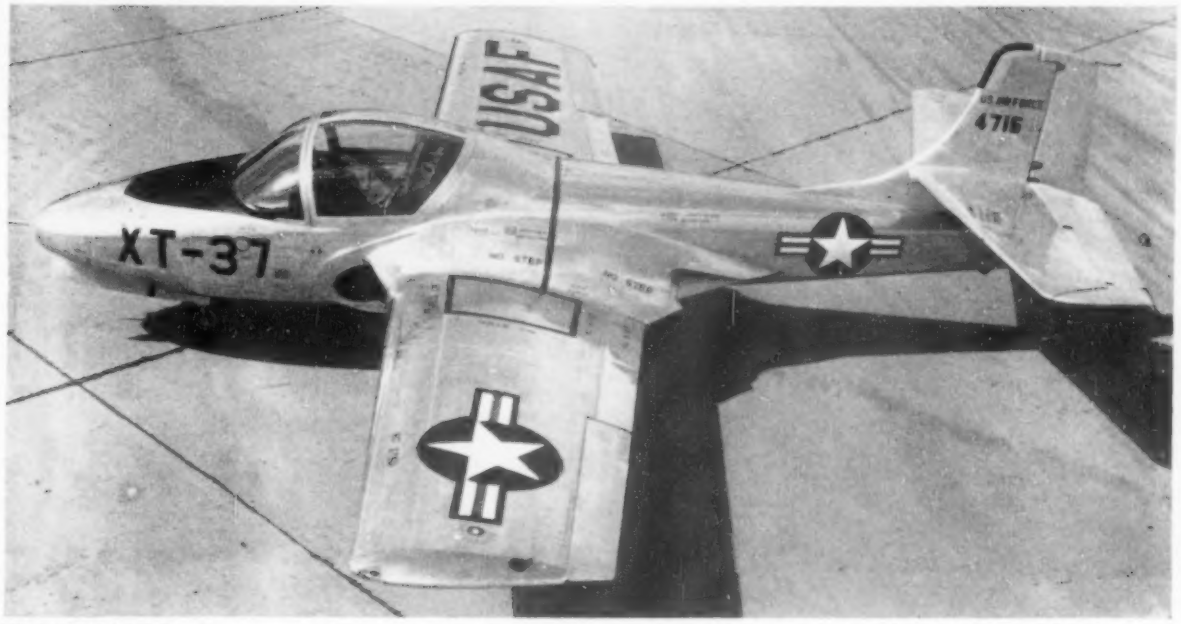
Sen. Leverett Saltonstall, chairman of the Senate Armed Services Committee, said the low level of obligations up to the May-June period "reflects, essentially, the introduction of more business-like buying practices. . . .

"Now that the transition to the new procurement ground rules has been substantially completed, the rate of obligations is beginning to rise sharply."

As of Sept. 1, USAF and Navy had a total unobligated balance of $10.2 billion: USAF, $7.3 billion; Navy, $2.9 billion.

July and August expenditures for aircraft and related procurement by USAF and Navy approximated expenditures for the same months last year.

Not announced by Talbott but revealed last week were an AF order for Cessna T-37s (see p. 15) and an additional $20-million Army order for the Nike missile from Western Electric Co. (AVIATION WEEK Oct. 11, p. 7).



SIDE VIEW OF T-37 shows roomy cockpit, trim lines of new Cessna intermediate AF trainer shortly before first flight, while . . .

FRONT AND THREE-QUARTER views emphasize low-slung design, wing-root takes for two Continental-built J69 turbojets.

Twin-Jet Cessna T-37 Makes First Flight

Cessna Aircraft Co.'s new twin-jet XT-37 intermediate Air Force trainer made its first flight last week at Wichita's new Municipal Airport.

Bob Hagan, Cessna's chief jet test pilot, flew the all-metal side-by-side trainer 1 hr. 5 min. on its initial hop, trailed by an Air Force T-33 and a Cessna 310.

"It sure is a honey of an airplane," Hagan, former Ninth Air Force P-37 and Strategic Air Command pilot, commented to a large crowd gathered for the first flight.

► **$4-Million Contract**—The T-37 is designed to teach intermediate USAF trainees the maneuvers and techniques required of military jet pilots. It is a low-wing monoplane with fully retractable landing gear.

Under its initial $4-million contract, Cessna will build 11 of the trainers. Production models will be T-37As. The plane is being put into production on the initial low rate manufacturing plan developed by USAF (AVIATION WEEK Apr. 12, p. 13, and Apr. 26, p. 11).

The T-37 has dual primary flight and engine controls and is powered by two 920-lb.-thrust Continental XJ69-T-15 (Marbore) engines.

The plane includes provisions for both day and night instrument flying, oxygen equipment, heating and ventilating system, jettisonable canopy and ejection seats.

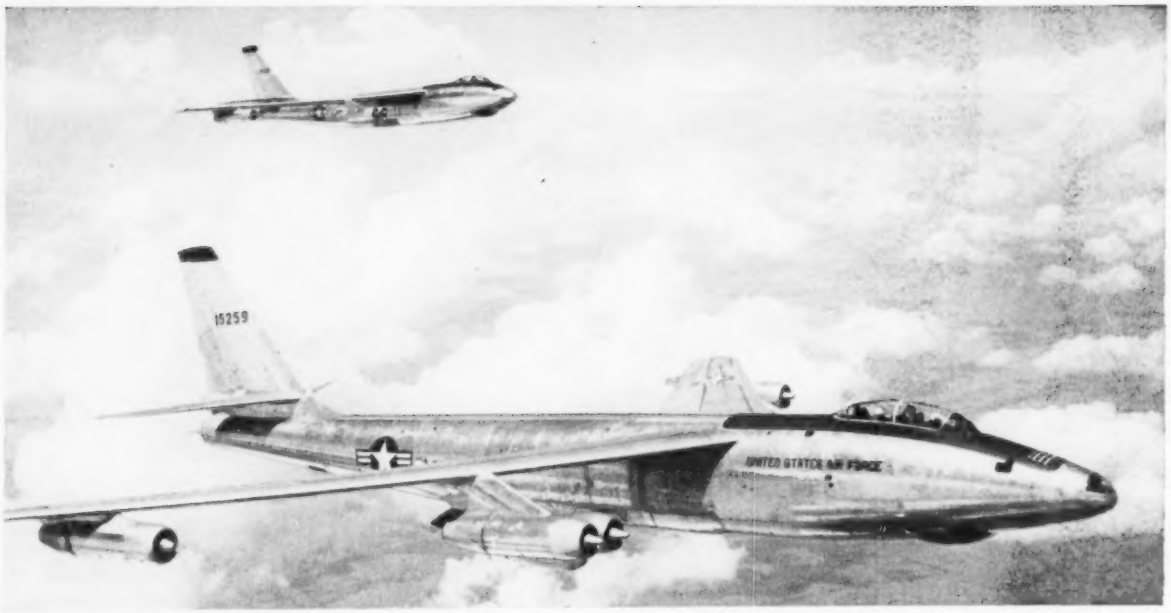
► **393-Mph. Speed**—Published specifications for the new trainer show it has a top speed at 35,000 ft., with ½ fuel capacity, of 393 mph. and a maximum range with 30 min. fuel reserve of 935 mi. Speed for maximum range at 35,000 ft. is 310 mph.

Single-engine service ceiling under military power, 820 lb. thrust for the Continental-built Turbomeca Marbore, is 19,200 ft.

Design gross weight of the T-37 is 5,600 lb. Empty weight is 3,116 lb., according to Cessna.

Other performance data: Stall speed, flaps up, 92 mph., flaps down 77 mph.; rate of climb at sea level under military power, 3,000 ft./min.; normal power service ceiling, with ½ fuel, 39,800 ft.

Other specs: Wing span 33 ft.; overall length 27.1 ft.; overall height 8.8 ft.; wing area, including ailerons and flaps, 181.8 sq. ft.; horizontal tail area 50.8 sq. ft.; horizontal stabilizer area 32.48 sq. ft.



STRATOJET TEAM, Boeing RB-47E photo-reconnaissance (foreground) and B-47E medium bomber, are shown in formation flight.

Boeing Rolls Out 1,000th B-47 Stratojet

The 1,000th B-47 Stratojet built at Boeing Airplane Co.'s Wichita plant rolled off the line last week.

At the same time, the company disclosed that Air Force project "High Noon," an overhaul and modification program for early B-47B models, is under way at the factory.

The 18-month schedule, involving 3,000 employes, will add 160 kits to each medium jet bomber plus six major modifications that will fit the B-47B with improvements not available when production started in 1951.

Rollout of the 1,000 Stratojet, a B-47E, marked more than 33 months of on-schedule production, according to Boeing officials. The total output figure, they said, does not include B-47s from the Tulsa, Okla., factory of Douglas Aircraft Co., and the Marietta, Ga., plant of Lockheed Aircraft Corp., the two other USAF sources.

▶**Combination Project**—"High Noon" is a combination of IRAN (inspection and repair as necessary) and modifications.

It is similar to the SAM-SAC (Specialized Aircraft Maintenance-Strategic Air Command) work under way at Ft. Worth, where Convair has 6,000 employes modernizing and reconditioning B-36 bombers (AVIATION WEEK Aug. 16, p. 264).

According to the Air Force, an identical program for other B-47 bombers soon will get under way at the two other factories where the aircraft is made. Project "Peach State" will go into effect at Marietta (Lockheed) and project "Oil Town" at Tulsa (Douglas).

▶**B-47B Rides**—The six major modifications that will be made on early Stratojets are:

- Installation of water-alcohol injection system to give a 17% takeoff boost to the bomber's General Electric J47 engines. Some structural changes are necessary for this modification.
- Installation of an external 33-rocket system to assist takeoff. This replaces an internal 18-bottle setup and provides up to 33,000 lb. of additional thrust. The external rack can be dropped after takeoff, shedding 4,400 lb. of weight.
- Relocation of equipment in the pilots' compartment. This results from improvement and expansion of the bombing-navigation system for easier maintenance and less tiring operation.
- Installation of approach 'chutes, 16 ft. in diameter. These can be released by the pilot to slow the plane and reduce the angle of descent during letdown.
- Installation of ejection seat equipment. The ballistically actuated system sends the pilot and co-pilot up, the observer down.
- Installation of 20-mm. gun turrets and related gear. This is a radar-directed General Electric cannon, replacing twin .50-cal. machine guns.

Announcing rollout of the 1,000th B-47 at Wichita, Boeing said these improvements and others added since the first XB-47 was built in 1947 have put more than 75,000 lb. of additional weight on the aircraft. Present production models weigh more than 200,000 lb., while dimensions have remained about the same.

Aircraft Design Paper Sparks SAE Session

Los Angeles—A basic treatment of the aircraft growth factor concept, praised as one of the milestones of aeronautical engineering, sparked a packed session at the Society of Automotive Engineers' national aeronautical meeting held here Oct. 5-9.

Dr. William F. Ballhaus, chief engineer of Northrop Aircraft, Inc., presented the derivation and application of the aircraft growth factor (ratio of change in gross weight to change in fixed weight) in one of the many technical sessions featured in the meeting.

Ballhaus' presentation was endorsed from the audience by Brig. Gen. Benjamin F. Kelsey, USAF director of research and development. Kelsey said the concept was basic and fundamental in its logic and a real milestone in engineering analysis, because it could be used to evaluate comparative designs as well as the growth of one configuration.

At the air transport meeting, the controversy between the merits of C-band and X-band radars was aired again in presentations by representatives of United Air Lines and Braniff International Airways.

More than 2,600 engineers and technicians attended the meeting. First two days were devoted to the production forum, a series of panel discussions on the many phases of engineering-production relationships, tooling concept and inplant communications.

The last three days featured technical sessions in aircraft design, powerplants, air transport and aircraft packaging.

CAB Acts to Clear Tiger-Slick Status

Civil Aeronautics Board acted quickly last week in an attempt to clear the future status of the two largest certificated all-freight airlines, Flying Tiger Line and Slick Airways, and pave the way for overdue consideration of continuing their east-west service.

At a hearing, CAB's Bureau of Air Operations recommended that the Board promptly approve a new operational arrangement proposed by the two lines, with one of two suggested alternative qualifications.

▶ **Recommendations**—Under the new proposal, Flying Tiger would quit the airfreight business and become a plane-leasing operation (AVIATION WEEK Sept. 27 p. 14).

Counsel for Bureau of Air Operations, John Stowell, recommended these alternative courses of action to the Board:

• **First,** that the "no competition" provision, under which Tiger agrees to cancel its application for renewal of its certificate and not to compete with Slick be withdrawn. In this case, he said, CAB should consider the proposal as simply a matter of sale and lease of aircraft and promptly approve it.

• **Second,** if this is not done, the Board should attach requirements for limited recompense to FTL personnel, unemployed because of the new arrangement, to its approval. Stowell reasoned that unless the "no competition" provision is eliminated, the proposal would have some attributes of a merger, entitling affected employes to some benefits due them under a merger.

▶ **Labor Claims**—Certificates of both lines expired Aug. 11. Efforts toward a merger, provoked by dwindling business and approved by the Board in January, have failed because of "exposure" to an uncertain liability in labor claims.

Meanwhile, hearings on the airfreight case were launched before CAB examiner James Keith, with consideration of north-south service first. Slick and Flying Tiger are applicants in this proceeding for authority to carry airmail, air parcel post and air express, as well as renewal of their freight certificates.

Other new developments:

FTL Wins Round

LOS ANGELES—U. S. District Judge James M. Carter has refused to issue a preliminary injunction to prevent the Flying Tiger Line from abandoning the airfreight business. But he has denied an FTL motion that the injunction suit brought by a stockholder be dismissed.

Carey E. Bowles of New York, owner of 350 shares of Flying Tiger common stock, filed the suit soon after the company announced that its proposed merger with Slick Airways would be abandoned (Aviation Week Oct. 4, p. 82).

Bowles charged that thousands of stockholders invested in FTL in the belief that the company was in the airfreight business.

In an oral decision, Judge Carter said business is like a poker game. When shareholders buy shares they take a risk, and they know the directors elected by the shareholders are in control of the company. In the absence of fraud or mismanagement, they are bound by the determination of the directors.

The judge pointed out that the airfreight business is very different from the usual type of business and that it is subject to overnight fluctuations which require frequent decisions on short notice.

To tie the hands of the company by issuance of a preliminary injunction would take away certain bargaining powers the directors need in operating this type of business, Judge Carter ruled.

• There no longer remains any possibility whatsoever of merger between the two freight carriers, Norman Meyers, Tigers' counsel emphasized. The FTL management decided that before a merger it must have definite knowledge of the amount of labor claim liability involved. It reached the conclusion that it is impossible to obtain this from labor unions.

If the new proposal is not promptly approved by CAB, he said, Tigers would "start from scratch" in another attempt to work out an arrangement.

• Flying Tiger will not withdraw its application for renewal of its freight certificate unless the pending arrangement with Slick is approved—or unless and until some other arrangement is worked out. "Maybe it'll be with American," Meyers remarked.

▶ **Slick Support**—Only opposition to the Slick-Flying Tiger proposal came from Roy Callahan, representing Flying Tiger pilots, and F. Harold Bennett, attorney for Air Line Pilots Assn.

Paul Jacobs, representing Slick pilots, as well as most other Slick employes, staunchly supported the arrangement.

Because of their faith in the company and their desire to keep it going as an airfreight operator, he reported, Slick employes volunteered wage cuts to the management and made other proposals for administrative and operational efficiencies.

NLRB Rules on Boeing

Discharge of a Boeing Airplane Co. employe for activities in connection with a union-sponsored manpower availability conference was an unfair labor practice, the National Labor Relations Board rules in a 3-to-2 decision.

The employe, Charles R. Pearson, a member of the Seattle Professional Engineering Employes Assn., served as director of the conference.

▶ **Gentlemen's Agreement**—The majority decision states: "The manpower availability conference was initiated to achieve two principal objectives—for purposes of mutual aid or protection, to secure other employment for those union members who desired to change employment and possibly to counteract the effect of the gentlemen's agreement. . . ."

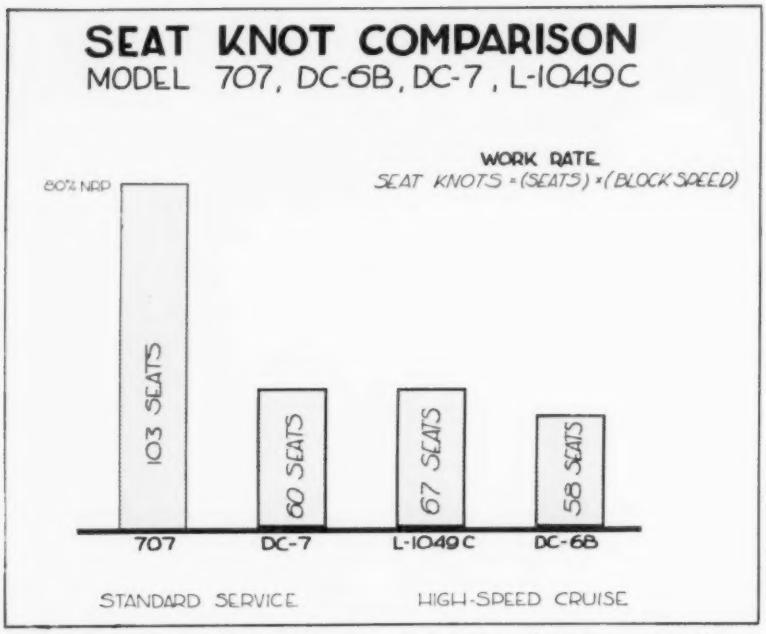
The decision says the gentlemen's agreement was an understanding among members of the Aircraft Industries Assn. that they would not offer to hire any employe of a member of AIA without first securing that member's permission.

Pearson was reinstated prior to the NLRB decision, but the majority rules that he is entitled to reimbursement for any pay loss.

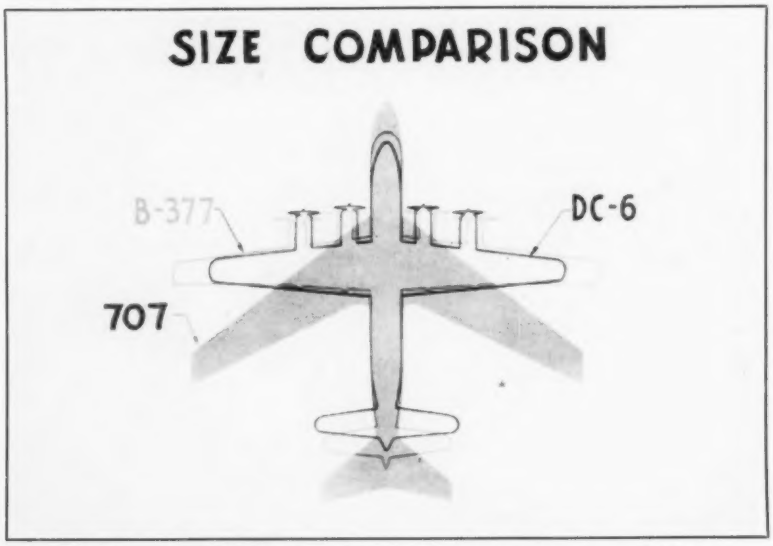
▶ **'Disloyal, Injurious'**—The dissenting opinion says: "The manpower availability conference was not a gathering together in concert of employes in order to compel the grant of a bargaining demand by a temporary refusal to work; it was, rather, an employment agency operated under the aegis of the union for the purpose of causing the permanent severance of the employment relationship.

"Such activity is the antithesis of the purpose of the (Taft-Hartley) act, which seeks to strengthen the bonds of cooperation between employer and employe. It is equally as disloyal, equally as injurious to the employer's business and equally as disruptive of industrial peace and stability as the conduct which was condemned in . . . (other) cases.

"Because it was conceived and utilized for purposes opposed to the purposes of the act, the activities of the manpower availability conference derive no protection from the guarantee of Section 7 of the act. The respondent's discharge of Pearson, because of his participation in such an unprotected activity, was accordingly not unlawful, and we would therefore dismiss the complaint in its entirety."



WORK RATE of the 707 would be three or four times that of present equipment.



PROPOSED PASSENGER VERSION of 707 compared with Stratocruiser and DC-6.

Boeing Promotes Jet Liner Sales

An airline version of the 707 jet transport will be capable of carrying 80 to 130 passengers nonstop across the Atlantic at 550 mph., Kenneth C. Gordon, Boeing Airplane Co.'s manager of commercial sales, said last week.

Cost per passenger-mile, he forecast, will be comparable to the best of present four-engine transports.

Gordon told a Montreal meeting of the Canadian Aeronautical Institute and the Institute of the Aeronautical Sciences that while the 707 will cost more than existing longrange transports, "the work rate of three to four times present equipment will result in no greater dollar expenditures than for slower equipment where the same amount of business must be handled."

▶**First Sales Pitch**—His speech was the first outward indication that Boeing is preparing to put a serious sales effort into marketing of a commercial version of the 707.

The company indicated when the big jet transport-tanker made its first flight last summer that Boeing had no commercial sales program and was interested primarily in USAF as a customer (AVIATION WEEK Aug. 9, p. 30).

Now that the military tanker order has materialized (AVIATION WEEK Aug. 23, p. 13), Gordon disclosed that Boeing's designers reported early in the "$15-million gamble" that commercial requirements could be met without penalizing the military possibilities.

▶**Meets Requirements**—The ability to correlate the military and commercial requirements, Gordon said, was one of the main reasons why Boeing went ahead with the project.

He told the Canadian meeting the 707 transport version will meet airline requirements for economy, safety, low obsolescence, performance and flexibility.

Gordon did not speculate on the probable initial or operating cost of the new transport. He said only that the economic requirements set up for the designers were based on competition with the DC-6B—"the best of present day four-engine equipment."

▶**Costs Revealed**—Operating cost figures, however, were given by M. L. Pennell, chief 707 project engineer, in Seattle.

Pennell said the 707 will have an operating cost of less than 10 cents a ton-mile, compared with 13 to 15 cents for the most economical of present transports. He explained this economy as a result of the 707's big capacity for work.

"It can carry more payload at more miles per hour," Pennell said. "The work capacity as expressed in ton-knots (the product of payload times block speed in knots) is three to four times that of current transports. . . . The higher cost per hour is more than offset by the far greater earning capacity."

▶**Cost Distribution**—On the distribution of costs, Pennell said: "Fuel costs are found to be moderate, at least by today's standards. Other costs are consistently less than those of today's planes except for engine maintenance, which includes spares and overhaul on a very conservative basis.

"Crew costs, although higher per hour in accordance with ALPA (Air Line Pilots Assn.) formulas, are divided by the larger work capacity of the new plane and show how much more can be accomplished with the same people."

▶**'New Standard'**—In his Montreal speech, Gordon said Boeing found it could meet the DC-6B economics target in terms of cost per seat-mile by matching the longest nonstop ranges operated today with sufficient payload.

"This important parameter, work capacity, coupled with the overall simplicity of the engines and departure from costly high-grade aviation fuels, will result in operating costs quite similar to today's operations."

Gordon said the 707 transport will cruise at 35,000 to 40,000 ft. with the cabin pressurized to 7,000 ft.

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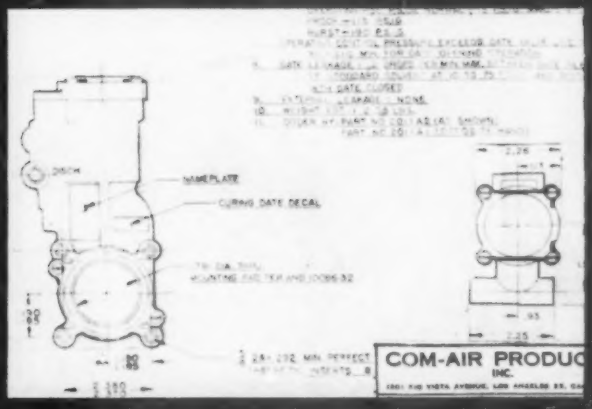

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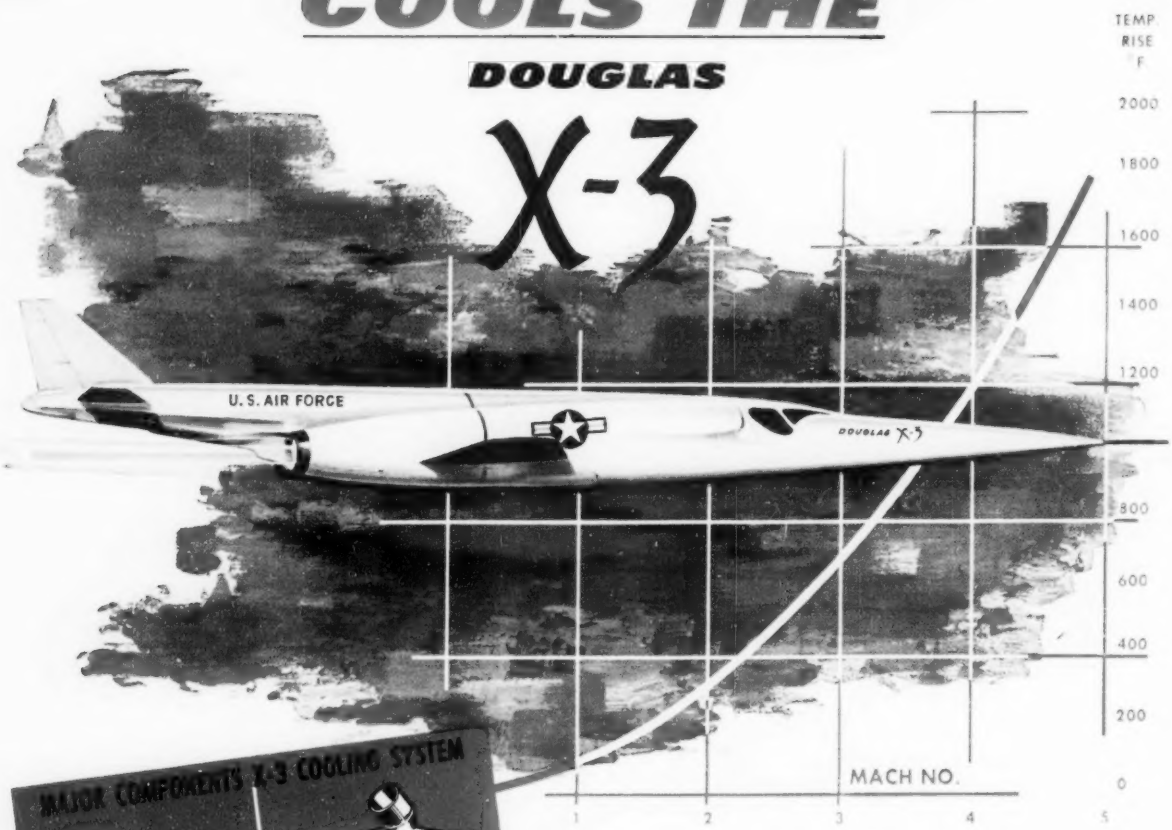

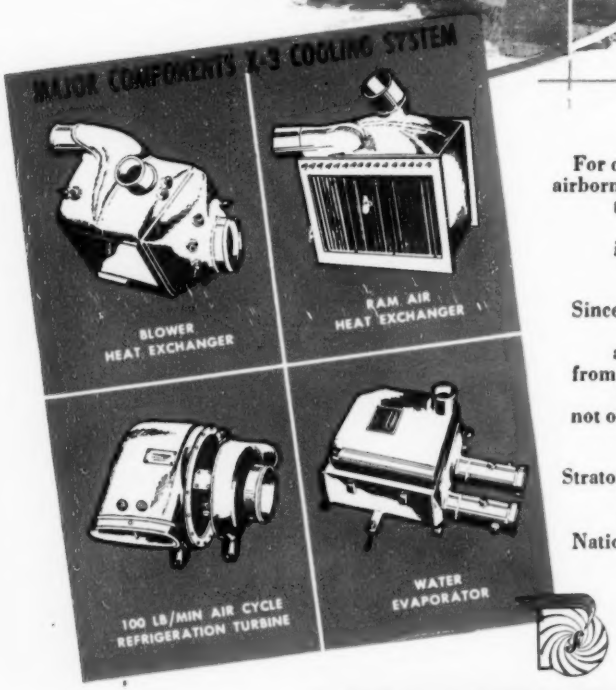
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Trends in Subcontracting–Fourth in a Series

Pullback Fight Unites Small Firms

Two groups form on the West Coast to battle deep cuts in business volume from prime airframe producers.

By William J. Coughlin

Los Angeles–Two associations of subcontractors have been formed in California to fight for the survival of a segment of the aircraft industry that has seen its income slashed by 74% in the past year.

These are the Small Defense Industries Assn. and the Aircraft Parts Manufacturers Assn. (AVIATION WEEK Oct. 4, p. 16). Both still are in the organizational stage.

Although the goal of both is the same–to maintain a high level of subcontracting–the two groups are competing for members and are taking somewhat different approaches to the pullback problem.

▶ **AIA Blessing**–The Small Defense Industries Assn. (SDIA) has obtained the blessings of Aircraft Industries Assn., Air Force, Small Business Administration and National Association of Manufacturers.

SDIA is an outgrowth of a session of the House Select Committee on Small Business, held here early this year. Manufacturers who appeared before that committee to air their grievances began discussing an organization to represent their interests in dealing with prime contractors and the Air Force.

The group also felt it could bring stability to the subcontracting level of the industry by setting up financial and quality standards that the major airframe plants would approve.

Finding that subcontractors in Texas and the East were faced with similar problems, SDIA set its course for national recognition.

▶ **Fighting 'Foreigners'**–The aim of the Aircraft Parts Manufacturers Assn. (APMA) is more provincial. Its board of directors has announced that one of the important goals of the new association is to keep all subcontracting by California airframe plants within the state.

APMA official Merle Davis declares that too many subcontracts are ending up in the hands of manufacturers in "foreign states."

"We intend to rectify this condition through our association as soon as possible," he says.

▶ **National Scope**–The Small Defense Industries Assn., on the other hand, is interested in subcontracting problems on a national basis.

Hampden Wentworth, president of Longren Aircraft Co. and chairman of the association, says: "We are fully aware of the importance of a stable, economic and healthy defense industry and because of the assistance SDIA can and will give to other qualified small defense plants throughout the nation, we are formulating plans to extend the SDIA into a national organization."

The organizing committee includes Paul Omohundro, president of Paul Omohundro Co.; Gen. W. W. Kratz, president of Electronic Products Corp.; J. C. Schwarzenbach, president of U. S. Propellers, Inc.; Lloyd Hallamore, president of Hallamore Manufacturing Co.; L. A. Pfankuch, general manager of

SDIA Targets

Announced aims of Small Defense Industries Assn.:

- To preserve intact, for the nation's benefit, the accumulated skills, experience and facilities of the small defense industries of America.
- To present the case of small defense industry to the country, Congress, and the Armed Forces of the United States.
- To cooperate with the major prime contractors for the most efficient and economical production of vital defense materiel.
- To conserve, for a balanced economy and a more stable base for the future progress of America, the contributions of small defense industry to national prosperity.
- To establish an effective basis for the exchange of experience, without affecting the competitive structure on which the progress of American industry ultimately depends.
- To strive constantly, by a more harmonious interrelationship between the various sectors of defense industry, to secure for the country all the benefits of the economies so effected.
- To set up such selective standards of performance that membership in Small Defense Industries of America automatically would command the respect and confidence of the industry.
- Thereby to procure for small defense industry the status and dignity and influence it deserves in the councils of the nation through its contribution to America's progress.

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APMA Goals

Announced aims of Aircraft Parts Manufacturers Assn.:

- To work in closer harmony with the major prime contractors and government agencies, as well as assure them of the quality of the product they are procuring.
- To promote, aid and support manufacturing, processing, fabricating and create more productivity.
- To set up a centralized clearing house for the allocation of all contracts submitted to the association.
- To disseminate information to members on aircraft activities all over the country on labor, taxation, finance, quality control and other data that will give a greater comprehension of the past, present and future of our industry.

Sturgess, Inc., and George S. Wing, general manager of Hi-Shear Rivet Tool Co.

SDIA has set up the following membership requirements:

- **Minimum size:** total employment of 10 and/or annual gross defense sales of $200,000.
- **Maximum size:** total employment of 500 and/or annual gross defense sales of $10 million.

Association officials say member companies must have an established record of financial responsibility and an established record of maintaining quality standards and delivery schedules.

▶ **Matching Skills**—In discussing the problems of the small subcontractor, Wentworth says: "We do not want to be regarded as a part of a subsidized industry. We believe that there is a place in the aircraft industry for privately owned, efficient, specialized subcontractors to support their program.

"We small businessmen who have grown up with the aircraft industry definitely want an opportunity to match our skills with other subs and the primes themselves. We do not expect subcontracts if we cannot save the prime money."

Wentworth's own firm, Longren Aircraft, employs 170 and depends entirely upon subcontract work to stay in business.

▶ **Subcontractor Problems**—SDIA lists these as the immediate problems facing the subcontractors:

- Lack of representation in procurement policy discussions at the national and regional levels.
- Pullback of subcontracts by major plants.
- Expansion of government-owned facilities at airframe plants to do work small plants already are capable of handling.
- Need for a tax program aimed at

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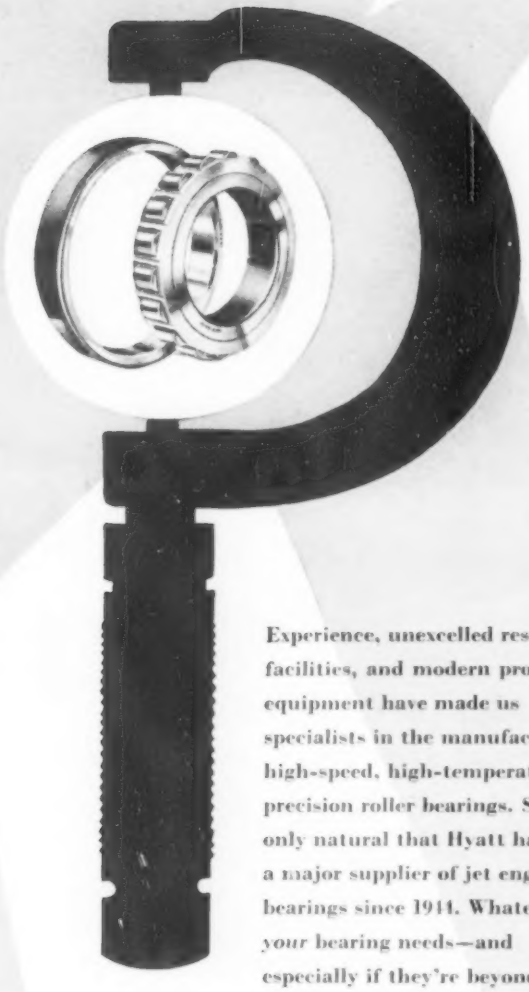

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Martin P4M-1 Long Range Navy Patrol Bomber
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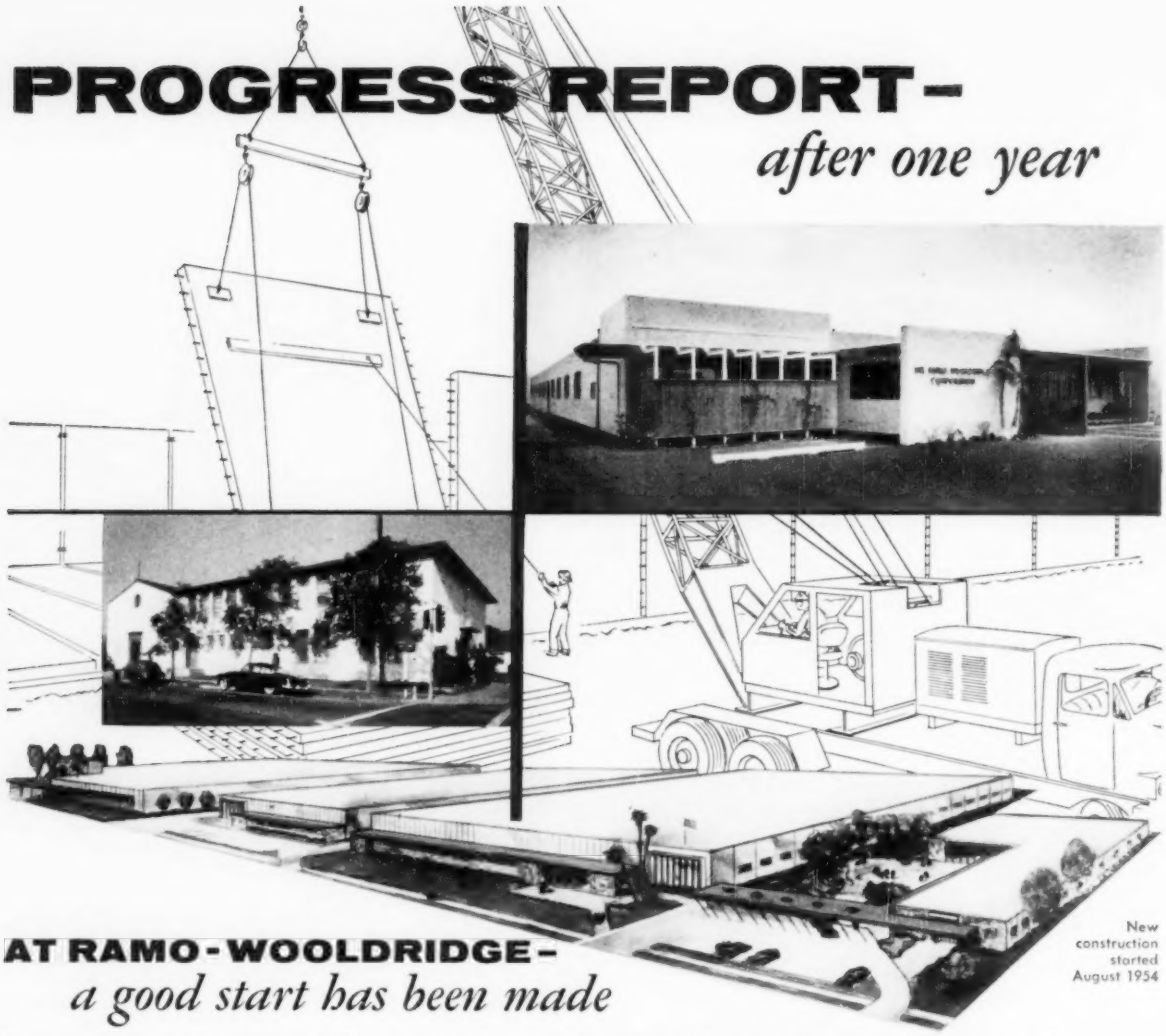

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Today, research and development activities are being conducted by an organization of approximately two hundred people, which will more than double within twelve months. Urgent project responsibilities have led to the temporary use of such quarters as the former school and church shown in the photograph, but construction is complete on 20,000 and well along on an additional 80,000 square feet of the 200,000 square foot permanent laboratory building program. Orders have been placed for $1,500,000 worth of digital and analogue computers that will be installed the end of this year to facilitate the extensive analyses required by current projects.

In the light of the first year's progress THE RAMO-WOOLDRIDGE CORPORATION anticipates expanding opportunities to perform major research, development and – a little later – manufacture in the fields of commercial and military electronic systems, and in guided missiles.

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stimulating growth of small business.

• Need for an adequate source of short-term working capital.

• Need for a coordinated program to sell the primes and military services on the quality, economy and dependability of small plants.

SDIA believes the Small Business Administration is doing a capable job but that the subcontractors should have an association of their own and not depend upon a government agency to represent them.

▶ **Delicate Relations**—SDIA sought approval and cooperation from Aircraft Industries Assn. early in its organizational stage. By doing so, it avoided the mistake of an earlier attempt to organize subcontractors.

AIA opposition was one factor in blocking a movement of accessory and component manufacturers to organize a subcontracting association last year (AVIATION WEEK Aug. 10, 1953, p. 15). That group was more concerned about the implications of the weapon systems concept than a pullback of business by prime plants due to Air Force cutbacks.

But since any association of subcontractors may expect its interests to clash at times with those of major AIA members, the question of relationship with the Aircraft Industries Assn. is a delicate one. Individual companies are reluctant to risk offending the prime manufacturers on whom they must depend for contracts.

▶ **Points of Interest**—Representatives of the embryo SDIA group called on Capt. Leland Webb, vice president and western regional manager of AIA, to discuss their objectives.

"We told Capt. Webb that the individuals interested in forming the association were fully aware that in some instances the points of interest of their group will differ from the ones of the AIA, that they also feel that they have many problems which they share and that they are confident they can work in the closest of harmony with the AIA," says Christina Wentworth, vice president of Longren Aircraft.

"One of the things discussed," says Capt. Webb, "was the possible establishment of procurement standards which could be utilized by prime contractors in the handling of their subcontracts and procurement of components from small manufacturers of the nature under discussion.

"This type of standardization would presumably be aimed at establishing uniformity in the handling of materials, inspection and general procurement details between the prime and the sub. This, if it could be accomplished, would be a saving all around and would benefit all concerned.

"There seems to be no question but that there is a place for an organization

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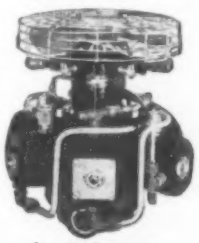

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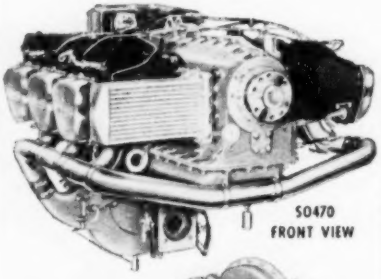

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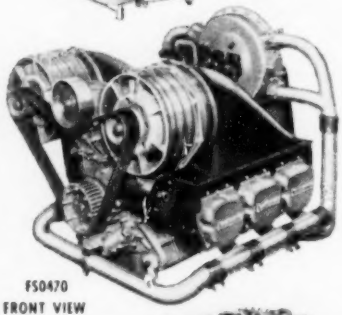
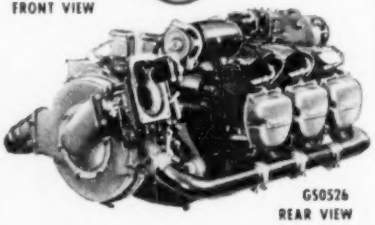


FS0470
FRONT VIEW



GS0526
REAR VIEW

GENERAL SPECIFICATIONS

	S0470	FS0470	GS0526
Horsepower	250	260	290
R.P.M.	2600	3000	3000
Alt. (ft.)	10,000	10,000	15,000
T.O. Power (Sea Level)	265	260	320
Length (in.)	37.73	39.64	52.28
Height (in.)	30.77	34.81	23.96
Width (in.)	33.62	33.62	34.68
Bore (in.)	5.00	5.00	5.125
Stroke (in.)	4.00	4.00	4.25
Displ. (cu. in.)	471	471	526
Comp. Ratio	6.0:1	6.0:1	6.0:1
Total Dry Wt. with Accessories (lbs.)	512	550	578
Type of Prop. Drive	Direct	Direct	Geared .688:1
Recom. Fuel Octane	91/96	91/96	91/96
Supercharger Ratio	12.45:1	10.13:1	12.0:1
Supercharger Drive	Belt	Belt	Gear

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of the general nature proposed," he adds.

In regard to a possible clash between AIA and SDIA, Capt. Webb comments: "I do not see any potential conflict by this proposed organization and our own association. In fact, I think they will be complementary."

▶ **SDIA Support**—Adm. Dewitt C. Ramsey, president of AIA, declares that since the small suppliers are considered a very important segment of the aircraft manufacturing industry, it is the association's policy to help them whenever possible—either as individual companies or as a group.

Backing for SDIA also has come from other sources. Roger Lewis, Assistant Air Force Secretary, has promised USAF support.

Philip Holle, West Coast manager of the National Association of Manufacturers (NAM), comments: "We believe there is a need nationally for a strong group of firms such as SDIA that are conforming to standards set up by the government. Both the AIA and NAM have been interested in the organization of the SDIA.

"We think the reason for the organization makes sense and can make a valuable contribution to the defense program."

In Washington, Wendell B. Barnes, head of the Small Business Administration, says: "The formation of the Small Defense Industries Assn. by an industry group of kindred defense producers appears to be worthwhile and wholesome, not only to the members involved but as a practical expression of the national policy to broaden the defense production base."

▶ **AIA Fears**—One aspect of any organization of subcontractors that concerns Aircraft Industries Assn. is the effect on the present relationship between prime aircraft manufacturers and subcontractors.

AIA fears any movement that might turn into a collective bargaining agent for subcontractors. AIA does not want its members to be forced to go through an association when they pass out their subcontracts, rather than dealing directly with companies on an individual basis.

Capt. Webb explains the reason: "Most of the large companies, as you undoubtedly know, give this subject very special treatment. Further, the procedures vary considerably among the primes concerned. The primes are familiar with the capacities, competence and reliabilities of their subcontractors and have established effective working relationships with them over an extended period of time.

"In effect, the selection of subcontractors by the primes assumes the complexity of a family affair and one in which the prime, for the most part,

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This is another example that shows why Greenleaf is regularly selected as a prime or sub-contractor by the following: U.S. Air Force, U.S. Navy, McDonnell Aircraft, Boeing, Emerson Electric Company, Eastman Kodak, Crosley Division of Avco, A.C. Spark Plug Division of General Motors, Glenn L. Martin Co., Chance-Vought Aircraft Co., J. P. Seebury Co., and other leading organizations.

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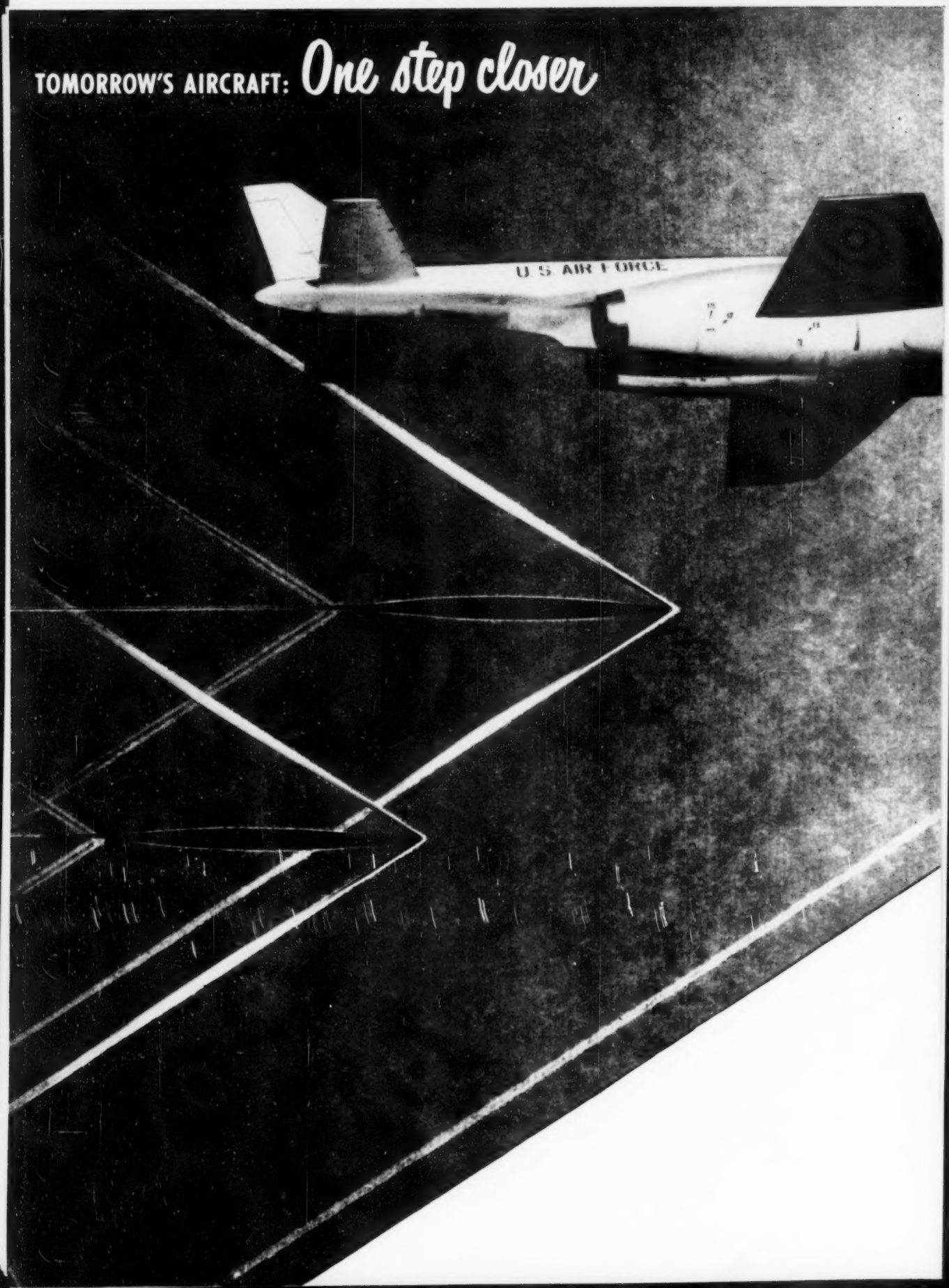

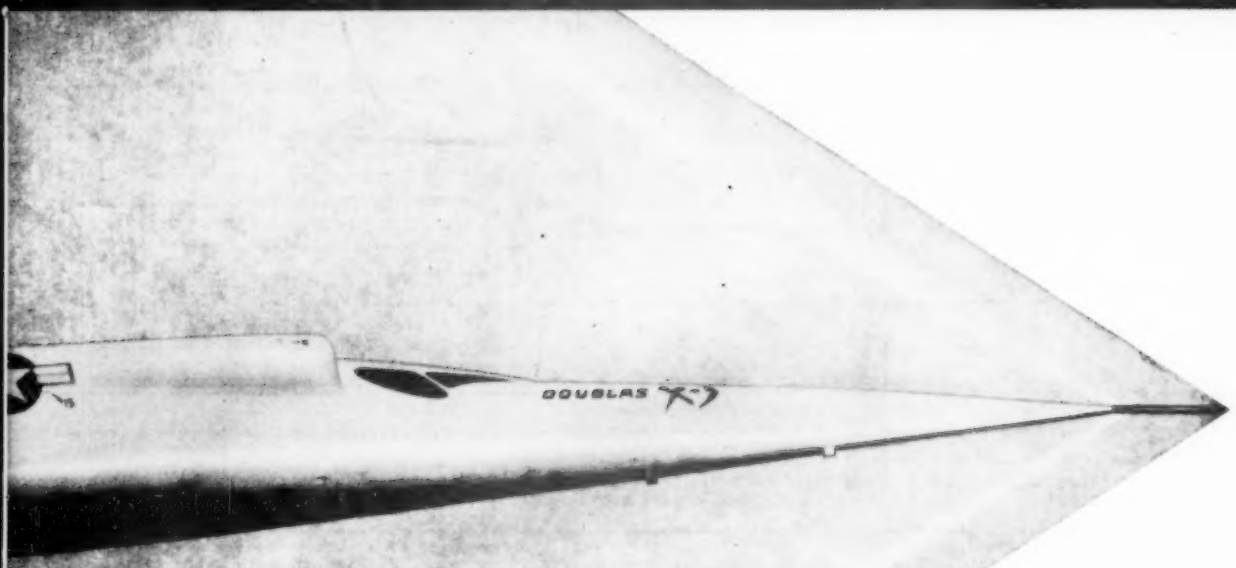

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Pushing further into the realm of supersonic flight, twin J34 turbojets with afterburners are pioneering the use of jet power plants for sustained, high-speed flight.

J34 axial-flow turbojets were chosen to power the X-3 because of important features such as small engine diameter and high thrust-to-weight ratios which permitted the use of two engines to provide excellent high-speed performance combined with multi-engine reliability.

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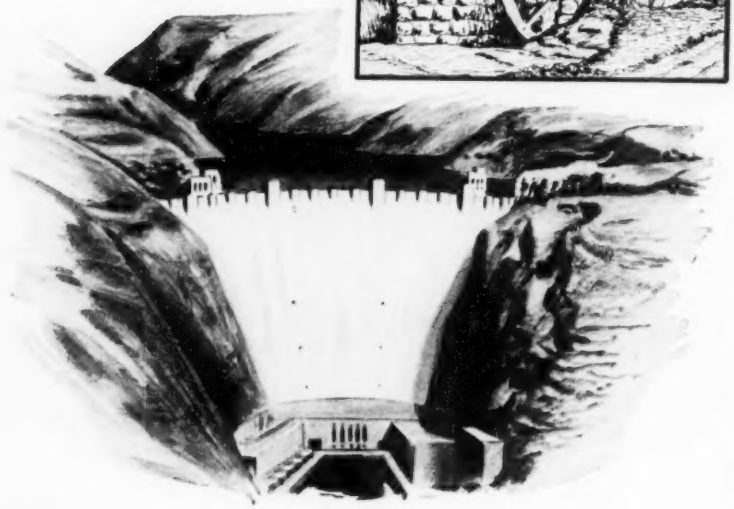

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needs as much freedom of action as possible."

Here is what a spokesman for the SDIA has to say on that subject: "In regard to the extent to which the SDIA would attempt to develop procedures governing the relationship of the prime and subcontractors, the answer is very little.

"We do not view the SDIA as a collective bargaining agent with the primes. Our whole function is to enable the prime to remain at all times competitive and to help them do the best and most economical job of defense production for the nation."

▶ **Cold Shoulder**—An announcement by the Aircraft Parts Manufacturers Assn. seems to imply a somewhat different attitude on this point. It says one of the aims of APMA is "to set up a centralized clearing house for the allocation of all contracts submitted to the Association."

This undoubtedly is one of the reasons AIA, while cooperating with SDIA, has turned a cold shoulder to the APMA.

Nevertheless, Louis Fox, chairman of the board of APMA and president of U. S. Relay Co., asserts that government procurement agencies have asked APMA to establish a clearing house to reflect the capabilities of each manufacturer in this area.

"Already we are getting greater attention for the contribution our parts industry is making in overall aircraft production," he says.

▶ **500-Member Goal**—APMA says its membership requirements cover industrial know-how, past satisfactory performance in supplying aviation products, financial stability and business integrity.

A recent membership list showed 35 companies enrolled. Goal is 500. One APMA meeting a few weeks ago drew more than 200 representatives from small companies and also from such airframe manufacturers as North American Aviation and Douglas Aircraft Co.

A member of the Douglas purchasing department told AVIATION WEEK he was there "to get acquainted" with the association.

The association has opened a Washington office for liaison with government procurement agencies and the Small Business Administration.

The organizing group of APMA included J. C. Copeland, president of the firm that bears his name; Louis Fox, U. S. Relay Co.; Rolla Florida and Merle Davis of Mendelson-McCarthy Co.; Ken Browne and Richard Daugherty of Browne and Lail, Inc., and Charles Catlin, vice president of the J. C. Copeland Co.

The association says its plans include finding solutions for financing the industry, dissemination of news and vital data, open forums to exchange informa-

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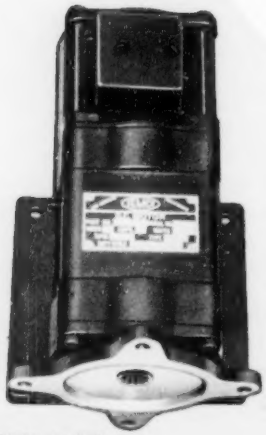
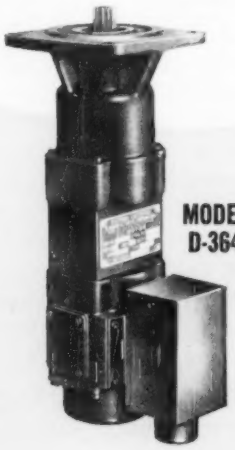


MODEL D-479

MODEL C-1076



MODEL D-364

MODEL C-875

MODEL D-479: EMERGENCY MOTOR FOR HYDRAULIC SYSTEMS ON INTERMITTENT DUTY

Operates to 160°F. Ambient temperature on a duty cycle of 1½ min. at 25.6 inch lbs., 5 min. at 8.0 inch lbs., then 30 min. rest period. Turns up 5500 r.p.m. on 24 volt D.C. at 90 amperes, with 2.75 HP output. Explosion proof. Weight: 14.75 lbs.

MODEL C-1076: SMALL VALVE MOTOR

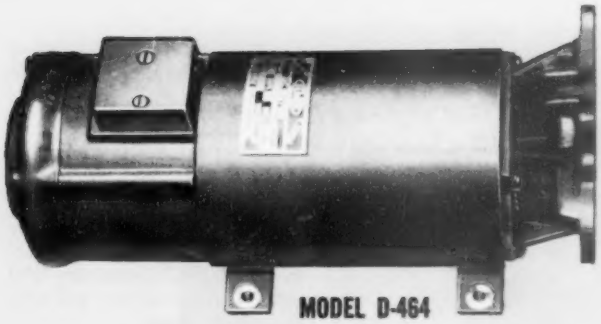
Only 2½" long x 1¾" x 1½"; weighs but 11.7 ounces. Operates on 26 volt D.C. at 2.9 amperes at 21,000 r.p.m. on split series, reversible. Output is 25 watts.

MODEL D-364: WING FLAP MOTOR FOR LARGE JET FIGHTER

Operates at 7400 r.p.m. on 26 volt D.C. at 62 amperes with 1.25 HP output. Has clutch and brake with static brake torque of 20 inch lbs., thermal protector, radio noise filter, is explosion proof. Weight: 11.2 lbs.

MODEL C-875: TWO SPEED RADAR ANTENNA AZIMUTH MOTOR

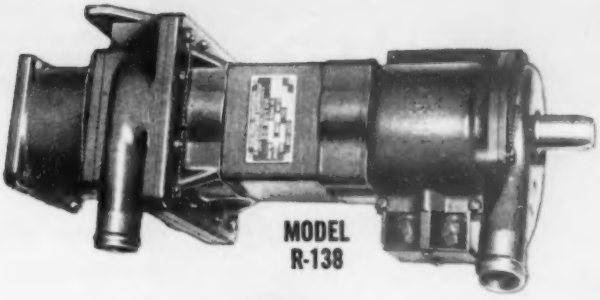
designed for continuous duty to operate at 3300 and 13,200 r.p.m. on 26 volt D.C. Rugged in construction, yet compact in size, it has a life of 2,000 hours. Weight: 2.75 lbs.



MODEL D-464

MODEL D-464: EMERGENCY STAND-BY MOTOR

for use on Supersonic Research Aircraft. Designed to operate at high ambient temperature of 70°C. at 50,000 foot altitudes. Duty cycle is 1 minute at 1 HP, 30 seconds at 2½ HP. High temperature materials used throughout. Motor weight, including gear box: 22½ lbs.



MODEL R-138

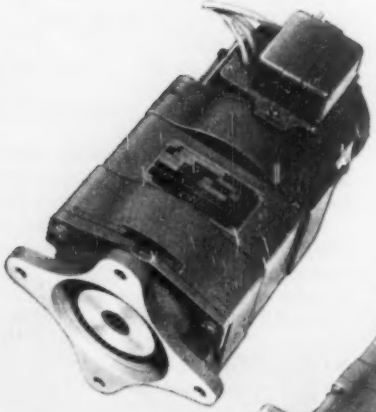
MODEL R-138: EXPLOSION-PROOF HYDRAULIC PUMP DRIVE

equipped with in-line gear reduction. Gear box designed to keep acoustic noise level at an absolute minimum. For continuous duty operation with duty cycle varying from 1½ to 5 HP load. Designed to operate for 2,000 hours without maintenance. Operates in a vertical position. Weight; 20½ lbs.

MODEL D-638

MODEL D-638: 400 CYCLE, 6.5 HP, A.C. MOTOR FOR INTERMITTENT DUTY

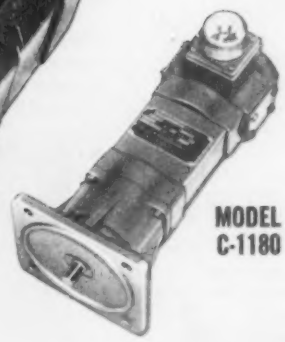
made to drive a hydraulic pump on a guided missile. Duty cycle is 3.0 seconds at 6.5 HP with 2250 r.p.m., 15.0 seconds at 1.5 HP. Has continuous rating of 5 HP at 2300 r.p.m., 15.8 amperes, 200 volts. Weight: 17½ lbs.



MODEL D-507

MODEL D-507: MISSILE APPLICATION MOTOR

This 2 HP, 115 volt D.C. motor provides 12,000 r.p.m. on continuous duty. An internal spline drive within the armature shaft allows for a close coupled, extremely compact assembly to drive a 400 cycle, 3 phase permanent magnet alternator. Provision is made in motor winding to maintain constant output speed with varying conditions of voltage and load. Unit is equipped with radio noise filter. Weight: 15.5 lbs.



MODEL C-1180

MODEL C-1180: STAND-BY MOTOR FOR HORIZONTAL STABILIZER

Has a duty cycle of 50 seconds on, 3 minutes off. Rated 13,000 r.p.m. on 25 volt D.C. at 21 amperes, with 0.5 HP output. Has 2 inch stack length. Weight: 4.25 lbs.

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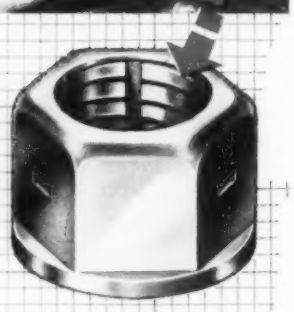

This is another example of Delron's long service and design experience at work—solving critical fastening problems!

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- ☐ Sandwich Structure Fastening

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tion and a program to keep purchasing agents advised of the capabilities of its members.

▶ **Early Rivalry**—Whether the two organizations, SDIA and APMA, eventually will coordinate their efforts and perhaps merge remains to be seen.

Their early attitude has been one of rivalry, not cooperation. Some industry observers believe their common objective—support of the subcontracting level of the industry—sooner or later will weld them into a single group.

But alone or together, both groups are preparing to fight developments they believe threaten the existence of the aircraft industry's subcontractors and endanger the nation's mobilization program.

Airport Aid

- **Program resumes after one-year suspension.**
- **Fiscal 1955 spending will top $20 million.**

By Craig Lewis

The federal airport aid program last week was resumed, following a year's suspension, with Commerce Department listing total grants of $20,425,843 from the $22 million appropriated by Congress for fiscal 1955.

The law requires that 75% of the appropriation be apportioned to the states on the basis of area and population with the balance going into a discretionary fund. This year, $15 million is programmed on the area-population formula, and $5 million will be spent wherever Commerce Department figures the need is greatest.

The 1955 federal aid money will be increased by a $1.5-million carryover from the fiscal 1953 discretionary fund.

The federal aid program was suspended during fiscal 1954 while Commerce studied the operation. After lengthy deliberation, the department decided it should be retained, with some changes.

▶ **O'Hare Grant**—Largest grant in the 1955 program is $1,665,000 for Chicago's O'Hare Field. Other large grants include $600,000 for the Port of New York Authority's International Airport, $500,000 for Portland (Me.) Municipal Airport and $500,000 for San Francisco's International Airport.

Balance of the appropriation consists of $750,000 to be spent on projects in Alaska, Hawaii, Puerto Rico and the Virgin Islands, and $1,250,000 for administration.

▶ **Criteria for Funds**—In deciding which

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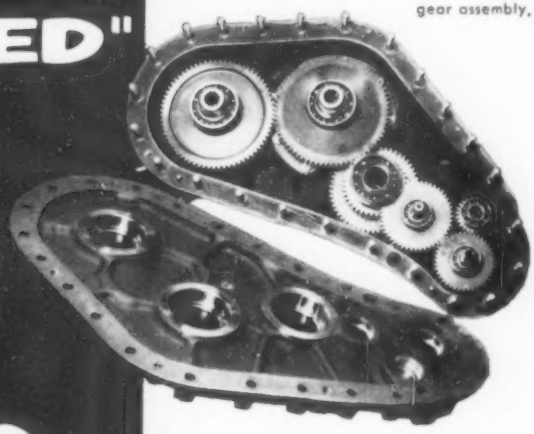

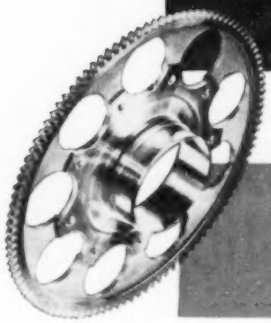

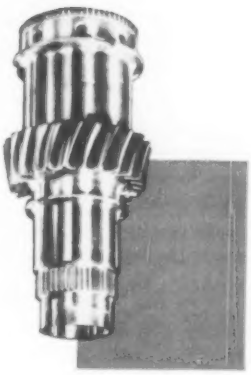

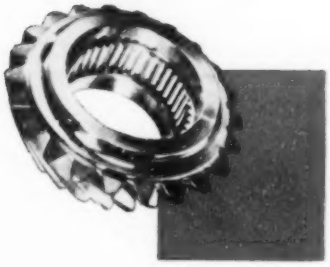

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With AMP's new Taper Technique, a special AMP Patented "F" Crimp Taper Pin is attached to the wires by high speed automatic machines. This pin is then installed in the connector with one easy and positive stroke of AMP's new "measured energy" CERTI-LOK insertion tool. The result is uniformly better connections, produced in much less time with tremendous cost savings.

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projects would be chosen this year, Commerce Department used a stricter yardstick. The criteria used were minimum traffic of either 3,000 passengers boarding airliners in a year of 30 airplanes permanently based at the airport, or some equivalent combination.

Expenditure of $20 million in federal funds will mean that an equal amount of local money will be spent, since the program is based on a 50-50 federal-local matching arrangement. But chances are that even more will be spent, with local officials encouraged by a final government decision.

There are substantial local funds legally tied to the expenditure of federal matching money through bond issue stipulations and other provisions and cannot be spent without some government participation. Estimates of the funds which will be released for use by federal allocations run as high as $130 million.

▶ **Economy 'Nudge'**—Announcement of federal airport aid allocation now fits in with Commerce Secretary Sinclair Weeks' statement of a few months ago that the government was going to try to get its various aid programs—highways, shipbuilding, airports—under way in the first six months of fiscal 1955 in order to give the economy a "nudge." It also gets federal money out to municipalities before it is hit by spending cutbacks which will probably be the chief feature of federal budgeting in the second half of fiscal 1955.

The $22 million appropriated this year brings the total spent during the nine years of the program to about $235 million. The federal aid program originally was set up in 1946 to spend $500 million over a period of seven years. Subsequently, this was extended an additional five years.

Appropriations have not kept up with the pace needed to realize the originally authorized program. Yearly allotments have ranged from a high of $45,000,000 in fiscal 1947 to $14,300,000 for fiscal 1953, the last appropriation before the present one.

▶ **Changes in Program**—The big change asked after the 1954 suspension was an increase in the discretionary fund from 25% to 50%. Commerce Undersecretary for Transportation Robert B. Murray, Jr., urged the move on the basis that: "An increase in the discretionary fund would make possible a much better adjustment of federal outlays in relation to points of greatest need."

Other changes recommended were establishment of traffic criteria and the exclusion of terminal buildings from federal participation, since they are revenue producers. The latter two points were adopted by administrative decision and were used in the current program.

▶ **Controversy**—When Murray went to Congress with the request for changing the discretionary fund, he encountered stiff opposition. The late Sen. Pat McCarran accused him of trying to be czar of the airport program. Many legislators felt changes asked by the Administration would give it too much power in deciding where money would be spent and would result in federal aid being concentrated in a few large metropolitan airports.

This controversy threatened to stall the airport program for another year, until the Administration decided not to push its bill asking greater control over funds. Subsequently, $22 million was requested in a supplemental appropriation bill, and Congress approved the entire amount.

Sponsors, name of airport and federal grants are:

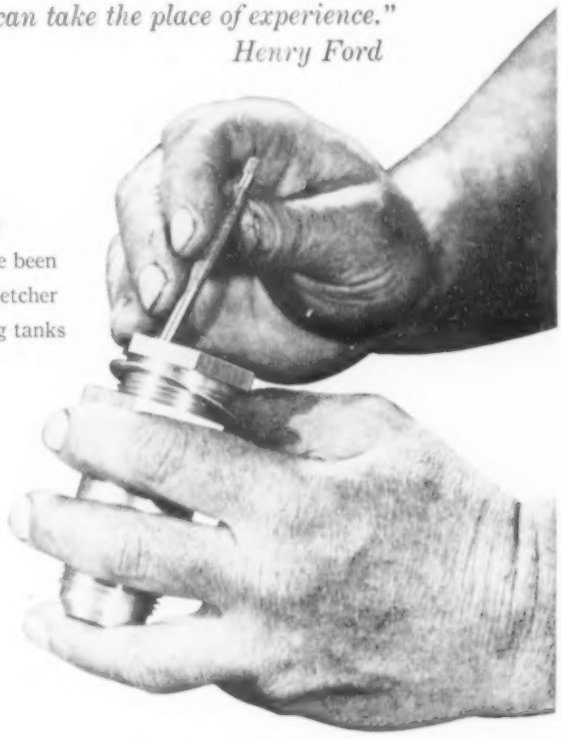
Alabama: Montgomery, Dannelly Field, $82,465; Huntsville and Madison County, Huntsville Airport, $123,500; Dothan and Houston County, Dothan Municipal, $50,000; Lauderdale and Colbert Counties, Muscle Shoals Airport, $13,850.

Arizona: Phoenix, Sky Harbor, $115,186; Tucson, Municipal, $147,996; Flagstaff, Municipal, $50,000.

Arkansas: Little Rock, Adams Field, $155,000; Fayetteville, Municipal, $32,000; Hot Springs, Memorial, $16,000; Harrison, Municipal, $25,000.

California: San Francisco and San Francisco County, International, $500,000; Los Angeles, International, $204,500; Long Beach, Municipal, $453,231; Los Angeles,

"No machine yet invented can take the place of experience."
Henry Ford



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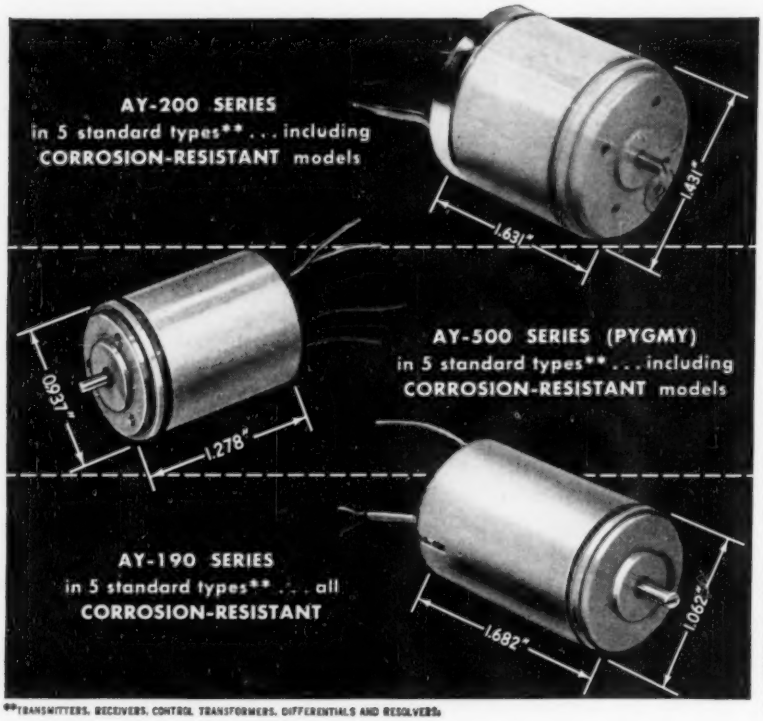

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San Fernando Valley, $339,100; Fresno, Air Terminal, $129,000; Kern County, Bakersfield-Kern County No. 1, $35,900; Ontario, International, $53,200; Oakland, International, $350,000; San Diego, Gillespie Field, $12,100; Merced, Municipal, $62,700.

Colorado: Denver and Denver County, Stapleton Airfield, $263,758; Colorado Springs, Peterson Field, $5,322.

Connecticut: Connecticut, Bradley Field, $30,000; Windham, Windham Airport, $15,000; Hartford, Brainard Field, $60,000.

Delaware: New Castle, Levy Court, New Castle County, $21,660.

Florida: Monroe County, Meacham, $130,600; Hillsborough County Aviation Authority, Tampa International, $33,000; Dade County Port Authority, Miami International, $300,000; Panama City Airport Authority, Fannin Field, $170,000; County of Pinellas, International, $39,425.

Georgia: Savannah, Travis Field, $16,560; Atlanta, Municipal, $47,000; Muscogee, Muscogee County, $45,000; Dougherty County and Albany, Albany, $13,100; Fulton, Fulton County, $125,000.

Idaho: Idaho Falls, Municipal, $77,000; Twin Falls, Municipal (Joslin Field), $51,400.

Illinois: Chicago, O'Hare Field-International, $1,665,000.

Indiana: Indianapolis, Municipal (Weir-Cook), $303,316; Evansville, Dress Memorial, $40,000; Marion, Marion Municipal, $112,000.

Iowa: Mason City, Municipal, $10,000; Waterloo, Municipal, $66,000; Dubuque, Municipal, $13,700; Fort Dodge, Municipal, $25,750.

Kansas: Kansas City, Fairfax, $16,500.

Kentucky: Louisville and Jefferson County, Standiford, $349,931; Paducah and McCracken County Air Board, Barkley Field, $100,000.

Louisiana: New Orleans Aviation Board, Moisant International, $400,000; Baton Rouge, Ryan Field (Harding), $341,472; Shreveport, Greater Shreveport, $88,400.

Maine: Portland, Municipal, $500,000; Rockland, Municipal, $10,000.

Maryland: Baltimore, Friendship International, $146,405.

Massachusetts: New Bedford, Municipal, $52,000; Lawrence, Municipal, $36,000; Commonwealth of Massachusetts, General Edward L. Logan, $167,760.

Michigan: Kent, Kent County, $190,000; University of Michigan, Willow Run, $100,000; Flint, Bishop Field, $60,000; Wayne County, Detroit-Wayne Major, $80,000; Michigan Dept. of Aeronautics, Capital City-Lansing, $100,000; Muskegon, Muskegon County, $21,530.

Minnesota: Minneapolis-St. Paul Airport Commission, International (Wold Chamberlan), $488,700; Minneapolis-St. Paul Airport Commission, Crystal, $30,000.

Mississippi: Greenwood, Municipal, $57,385; Natchez and Adams County, Natchez-Adams County, $45,588.

Missouri: St. Louis, Lambert-St. Louis Municipal, $316,000; Columbia, Municipal, $18,000; Joplin, Municipal, $31,560.

Montana: Billings, Municipal, $333,302; Miles City, $17,885; Butte, Municipal, $5,170; Great Falls, Municipal, $16,580.

Nebraska: North Platte, Municipal (Lee Bird), $50,000; Sidney, Municipal, $50,000.

Nevada: Elko, Municipal, $93,337; Clark County, McCarran Field, $31,914.

New Hampshire: Laconia, Municipal, $34,000; Berlin, Municipal, $15,000.

New Jersey: Mercer County, $175,000, Port of New York Authority, Newark, $220,000.

New Mexico: Grant County, Silver City-Grant City, $31,905; Hobbs, Lea County (Hobbs), $23,085.

New York: Buffalo, Municipal, $300,000; Port of New York Authority, International, $600,000; Monroe County, Rochester-Monroe County, $115,000; Warren County, $125,000; Jamestown, Municipal, $75,000.

North Carolina: Charlotte, Douglas Municipal, $62,086; Raleigh-Durham Airport Authority, Greensboro-High Point, $52,025; Asheville, Municipal, $107,308.

North Dakota: Fargo, Hector, $50,000; Bismarck, $5,565; Williston, Sloulin Field, $12,800; Devils Lake, $5,000; Minot, Port O'Minot, $50,000.

Ohio: Cleveland, Cleveland-Hopkins Mu-

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nicipal, $591,325; Columbus, Port Columbus, $500,000; Dayton, Municipal, $90,000; Scioto City-County, $305,000.

Oklahoma: Oklahoma City, Will Rogers, $83,000; Tulsa, Municipal, $117,000; Duncan, Halliburton, $58,000; Bartlesville, Frank Phillips Field, $17,000.

Oregon: Medford, Municipal, $45,000; Portland, International, $246,800; Pendleton, Pendleton City, $18,909.

Pennsylvania: Allegheny County, Greater Pittsburgh, $25,000; Erie Municipal Airport Authority, Port Erie, $150,000; Philadelphia, International, $150,000; Commonwealth of Pennsylvania, Harrisburg State, $100,000; Lehigh-Northampton Airport Authority, Allentown-Bethlehem-Easton, $116,500; Philadelphia, North Philadelphia, $300,000; Allegheny County, Municipal, $250,000.

South Carolina: Greenville, Municipal, $40,000; Columbia, $19,000; Florence, Municipal, $5,000; Spartanburg, Memorial, $12,000; Sumter, Municipal, $83,000.

South Dakota: Aberdeen, Saunders Field, $21,500; Sioux Falls, Municipal, $50,000; Rapid City, Municipal, $14,500.

Tennessee: Nashville, Berry Field, $190,729; Memphis, Municipal, $247,707; Johnson City-Kingsport-Bristol and counties of Sullivan and Washington, Tri-City Municipal, $46,344.

Texas: Austin, Robert Mueller, $345,000; Houston, Municipal, $100,000; San Antonio, International, $150,000; Lubbock, Municipal, $32,000; Dallas, Love Field, $150,000; Fort Worth, International, $152,500; Jefferson County, $101,759.

Utah: Salt Lake City, Municipal No. 1, $214,024.

Vermont: Barre and Montpelier, Municipal, $40,000.

Virginia: Richmond, Richard E. Byrd Flying Field, $150,000; Roanoke, Municipal (Woodrum Field), $60,000; Peninsula Airport Commission, Patrick Henry, $21,000.

Washington: Seattle, Seattle-Tacoma International, $310,560; Yakima, Municipal, $51,000; King County, Boeing Field-(King County), $136,000.

West Virginia: Tri-State Airport Authority, Tri-State-Huntington, $90,000; Raleigh County, Memorial, $85,000.

Wisconsin: Milwaukee County, General Mitchell Field, $86,550; Milwaukee County, Curtiss-Wright, $99,000; Brown County, Austin-Straubel, $62,500; Eau Claire, Municipal, $5,000.

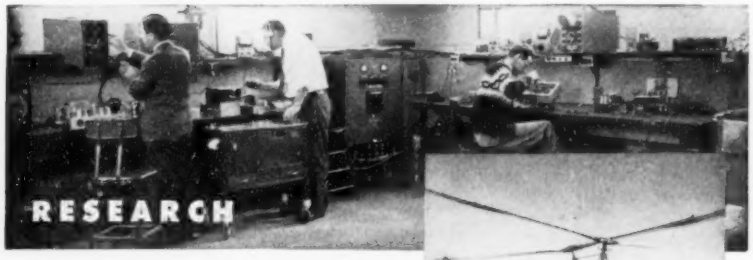
Wyoming: Natrona County, $45,000; Cheyenne, Municipal, $40,000; Laramie, Brees Field, $6,870; Teton County and Town of Jackson, Municipal, $68,700, Rock Springs, Municipal, $25,763.

Alaska: Juneau, $60,000; Ketchikan Seaplane Facility (New), $56,250; Wrangell Seaplane Facility (New), $54,375; Municipal (New), Bethel, $54,375.

Hawaii: Hilo-Lyman Field, $134,000; Molokai-Kaunakakai, $44,000; Kamuela, $46,500.

Puerto Rico: International, $250,000.

Virgin Islands: St. Croix, Alexander Hamilton, $50,000.



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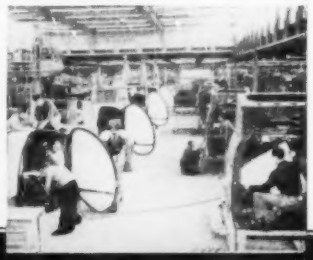
To design and develop such outstanding helicopters as the HTK-1 and the HOK-1, Kaman Aircraft has assembled a complete engineering staff skilled in the fields of mechanical design, electronics, aerodynamics with special emphasis on the development and production of electro-mechanical devices and systems. Moreover, the production of Kaman helicopters requires large plant facilities and an impressive inventory of machine tools and equipment from the smallest electronics part to presses of huge capacity. Each contributes to Kaman Performance, and . . .



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Allegheny Asks Action On LCA Merger Case

Allegheny Airlines has asked Civil Aeronautics Board to step up action on the Lake Central Airlines acquisition case.

The acquisition case has been at the Board in one form or another since September 1952, when North Central Airlines filed a plan to acquire stock control of Lake Central.

A year ago, CAB launched a merger investigation that still is under way. Ozark, North Central and Allegheny are involved in the proceeding.

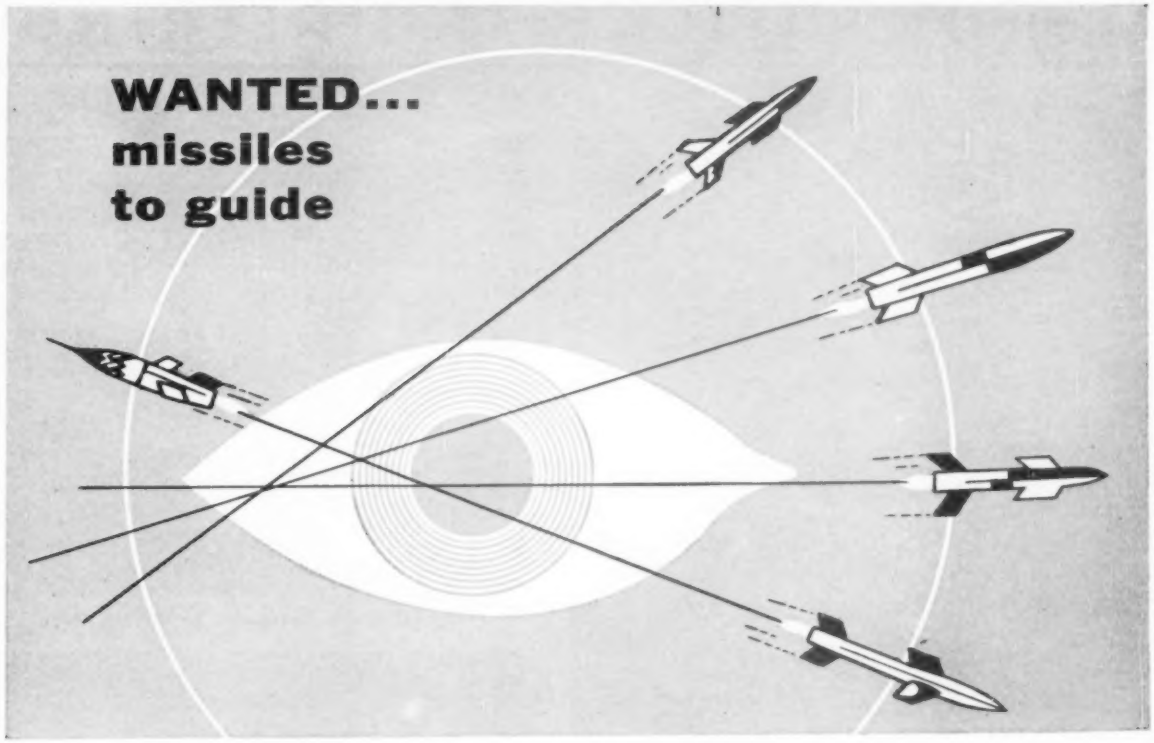
▶ **Subsidy Savings**—Allegheny maintains that if it took over LCA's Ohio routes, "those routes could be operated with a minimum of two roundtrips per day at an annual saving of $289,000 to the federal government through reduction in mail pay."

If certain suggested changes were made in the Ohio route alignment, Allegheny estimates that further savings would produce an overall annual saving to the government of $397,000.

▶ **'The Issues'**—The brief filed by Allegheny describes Lake Central as:

"A local carrier (1) whose dependence upon mail pay is not lessening; (2) whose financial situation, in fact, has steadily deteriorated between February and August of this year in spite of the fact it has operated on a permanent mail rate during these months; (3) whose operating results do not lend future promise for lessening dependence upon mail pay; (4) whose mail pay requirements today are one of the highest among the local service carriers on a per-plane-mile basis, and (5) whose own officers and prospective purchasers state they will not be in a position to complete studies or propose a remedy to correct this situation until at least 1958. . . .

"These five observations point up the urgency for early pursuit of the Board's initial determination to investigate the issues," says Allegheny.



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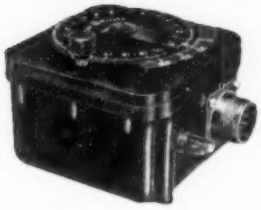

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The solution depends upon the efficiency and the reliability of the controlling parts.

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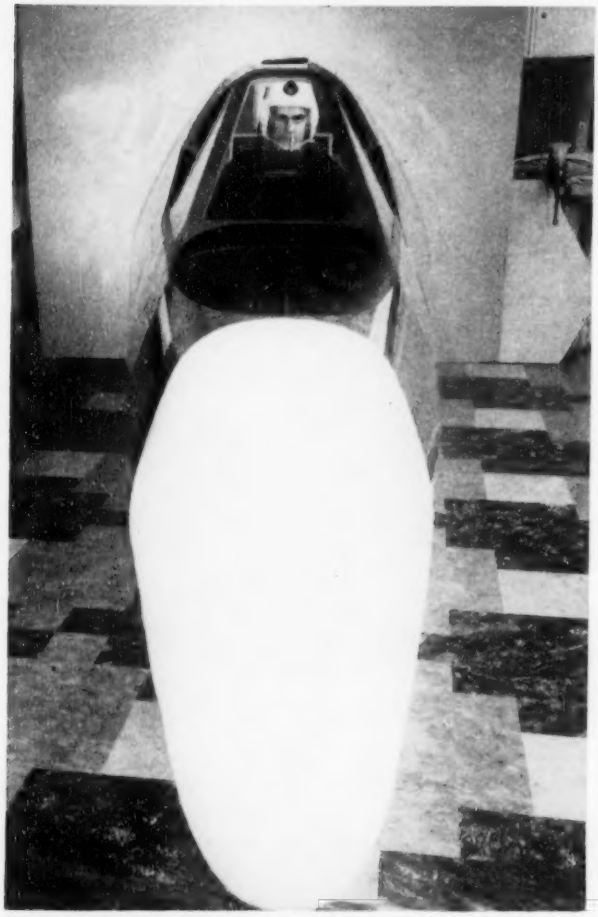
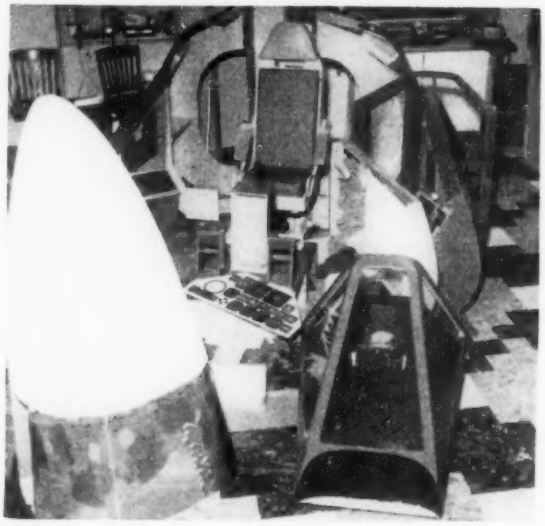


FIGHTER-BOMBER COCKPIT MOCKUP made in Martin's 3-D layout shop during proposal stage of design development.



PARTS are lightweight, inexpensive, go together easily.

MOCKUP'S INSTRUMENTS and panels are buttoned on, best arrangement achieved by "playing checkers" with individual units.

Advanced Design Covers Big Field—For Instance . . .

Martin Team Pushes Anti-Gravity Study

By Irving Stone

Baltimore—The scientific vision of harnessing new natural forces to overcome gravity may not be an empty dream.

Clues have indicated to scientists at Glenn L. Martin Co., after a relatively short period of theoretical study, that it may be possible to overcome the force of gravity—man's leg iron—by means other than those now used.

▶ **Man's Leg Iron**—The work at Martin is part of an overall search into the basic laws of nature—probing the unknowns in any field that appears to have application to airborne weapons and factoring the results into the military vista of the immediate and the far future.

In Martin's anti-gravity study, the unified field theory—Einstein's concept of the basic law of the universe—is getting an intensive look. Reason: Wrapped up in this theory is a key to the explanation of the force of gravity and the relationship to other phenomena (such as electromagnetics) which may be vital factors in the anti-gravity solution.

Gravity has always been the aircraft designer's basic problem. In the airplane it is counteracted by engine power-plus-wings. In today's rocket, brute thrust of the motor alone does the job. With the spaceship, new approaches and techniques probably will be required.

One approach—in some respects along the lines of conventional methods still being pursued—will be to devise a small engine-package of very high power, easily generated.

But Martin scientists are also following an alternate approach to uncork a new force to defy gravity. No one will hazard a guess on how long it will take to develop theory, and from there go on to the prodigious physical fact.

▶ **Advanced Design Projects**—Martin's investigation of the unified field theory is only one project in a long string of items already under study or scheduled for attack in the company's Advanced Design Department.

This is a top-level activity created recently, with George S. Trimble, Jr., heading it in his new capacity as one

of Martin's vice-presidents. Encouraging force behind the work is George M. Bunker, Martin president.

Other studies and projects now being pursued in Advanced Design include:

• **Nuclear physics.** Emphasis in this work is on shielding, propulsion and use of tracers, in relation to aircraft and allied fields, Trimble reports.

A lot of basic effort is going into study to overcome the major drawbacks —bulk and weight—of present-day shielding. This approach is broken down into two general aims.

One is to improve shielding by creating a more efficient structure. Solution to this problem may require a decade or more.

Second, and more radical, approach is to devise a means of eliminating the shielding altogether. This, undoubtedly is a much longer-term problem than any mere shielding improvement would involve. The achievement of a nuclear reactor without a shielding requirement as we know it today, could offer tremendous benefits for aircraft installations and certainly is worthy of Martin's high-level efforts.

Advanced Design's activities in the nuclear aircraft propulsion field are closely allied to its work in shielding. The aim here is to ferret out more effective means than already have been proposed and publicized for this type of power.

Radioactive tracers hold an important slot in Advanced Design's nuclear physics activity. Use of tracers as aids in manufacturing and inspection, and for test work are seen as fruitful fields for research. In test work, they could help determine precise behavior of boundary layer air in windtunnel trials.

• **Human engineering.** Basic problems in this field are being investigated for Martin's Advanced Design Department in the University of Maryland, under contract. Other universities also will be brought in because it is felt that the higher-school atmosphere is better for this sort of research, Trimble feels.

Obviously, how a pilot or crewman functions under extreme conditions of flight is going to take on increased significance in relation to future designs, where speed and altitude levels will be raised considerably and extremes of temperature experienced.

• **Natural phenomena.** Basic search into the laws of nature has high priority in Trimble's Advanced Design section. Studies are being conducted at Martin and at universities, with both activities slated for expansion. In universities, extension of the work is expected to find its way into theses for advanced degrees.

One of the important theoretical studies now being conducted in a university is in connection with dissocia-

Trimble and Advanced Design

George S. Trimble, Jr., new 38-year-old vice-president of Glenn L. Martin Co., heads the organization's Advanced Design Department. Recently created, it is concerned with search in pure science, immediate- and far-future designs, and over-the-horizon explorations in aeronautics.

A veteran of 17 years of service with Martin, Trimble was graduated from Massachusetts Institute of Technology in 1936, joined company the following year, worked as draftsman for three years. From 1940 to 1943 he was in Aerodynamics, then spent a year in New Design. From 1944 to 1946 he was engaged in propulsion research, then returned for another year in new design work.

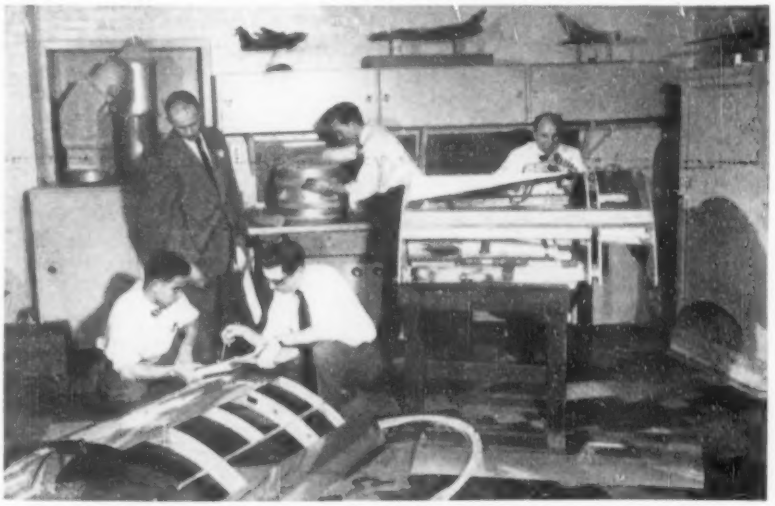
From 1947 to 1951 he was chief of Aerodynamics (originally named Fluid Dynamics), then became head of Design Development, a department initiated in 1951. In August, this year, he was made a vice president, with Advanced Design his personal responsibility.

He is a member of the subcommittee on highspeed aerodynamics for the National Advisory Committee for Aeronautics, and a member of Tau Beta Pi, national honorary engineering fraternity.

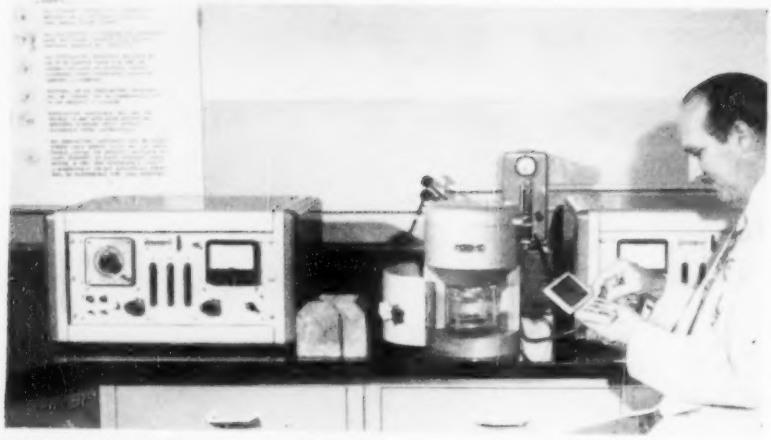
Plane model shown above with Trimble is a night intruder configuration, one of many designs investigated in studies of advanced planes for possible tactical Air Force application.

The jet engine air inlet ducting is not part of wing root but is located under wing so that the latter has a continuous structure for maximum strength and thinness. Broad wing fairing at rear houses landing gear and considerable equipment requiring air. Pointing aft atop the rear of the fairing is fixed armament.

The horizontal tail is placed sufficiently aft to afford the required stability, then connected by a sharply swept fin to the fuselage. This scheme allows the shortest possible fuselage to be used, to cut down on structural weight. To sight aft, there is a radar high on the tail.



CORNER of 3-D layout shop, where models can be made quickly for advanced design.



NUCLEAR RESEARCH ties in closely with Martin's new advanced design activity.

tion of gases. Aim is obtain data to help in the design of highspeed missiles so that they will not burn up as they hit the "heat barrier." This factor takes on more and more significance as missile speeds soar.

• **Ballistics.** This Advanced Design program is broken down into four main categories of investigation, Trimble told AVIATION WEEK:

The spaceship is being studied with regard to feasibility and usefulness of the vehicle projected against cost and expected benefits.

The satellite vehicle and associated factors also are under study—how to get a vehicle out to its path and how to use it after it is there. Applications might include a weather station or a high-altitude (100-200 mi.) research platform to study cosmic or ultraviolet ray phenomena.

The rocket as a ballistic weapon is another phase of work, where many unknowns have yet to be unraveled by researchers.

The Viking, Martin's well-known and highly successful ballistics rocket, is still the subject of a research program for the Navy, on which the company is working under contract.

• **Seaplane development.** This looms as an important parallel development to the nuclear powerplant as now envisaged. Although Martin engineers have made no comment on the advantages of the seaplane for application of nuclear power, industry observers believe the seaplane considerably safer for such a powerplant. It offers precautionary shielding on landing by lowering the "hot" elements into the water (AVIATION WEEK, Jan. 11, p. 10).

Other advantages for water-based craft include natural lengthy takeoff distance (which otherwise would demand special heavy-duty, extra-long runways), safety in emergency landings, and sufficient distance from populated areas.

Big advantage Trimble sees for the seaplane is the mobility of its base. The craft could rendezvous with a submarine to take on fuel or, if the plane were big enough, to refuel the sub.

Also, for cargo service, the seaplane is seen as more favorable for landing numbers of troops and supplies close to advance bases, where the landplane would first have to be provided with a substantial runway.

Recent efforts directed toward the jet-powered seaplane have refined hull design so that drag is only about 4% more than with the best landplane. It is felt that seaplanes now can be built to perform a mission which will compare with any landplane in respect to performance, weight and cost.

Seaplane handling also is getting Advanced Design's close attention. Martin's concept is to leave the plane in the water for servicing or maintenance operations.

• **Air-launched missiles.** Both air-to-air and air-to-ground categories are under study. The designs lay particular emphasis on simplicity of guidance systems to insure high reliability.

Martin's experience in the design of complex missiles is considerable. But now the company is taking another look at the overall problems and backing off from the concept that the missile has to do all the "thinking."

The new approach is that the man in the plane should be a much more integral part of the missile system than previously.

New thinking is to make sure full use is made of the pilot's every ability—human engineering studies tie in with

Anticipating the Military

How far does Advanced Design, as conceived at Glenn L. Martin Co., reach out into the future? One of the extreme aims of this new department is to anticipate aeronautic needs on a basis projected so far ahead that, at the fringe of the thinking, there is no clear picture of what the requirements might be.

Advanced Design is the latest step in the natural progression from the earlier industry custom known as preliminary or new design. In this, an aircraft was designed in industry competition to meet the requirements of a customer-written specification wherein main details and associated systems, etc., have been set down and defined.

Next jump after the preliminary design setup was to systems design, which was somewhat similar, except that in addition to designing the airframe, the builder defined and/or designed the associated systems to obtain the best compromise within the scope of the original specification. This was, in effect, the beginning of the weapons systems concept at Martin. It was related mainly to non-competitive articles. (The Martin Matador B-61 pilotless bomber is a prime example—in this project, Martin went so far as to determine how many men it would take to assemble the missile in the field, movement-to-firing line details, and final operational aspects.)

In both the preliminary design and systems design efforts, everything submitted is based on present-day knowledge with, possibly, a very short time-extension in which to push forward the state of the art (usually amounts to last-minute proving). This approach is logical in sense of "keeping both feet on the ground" and avoiding untried concepts to any great extent.

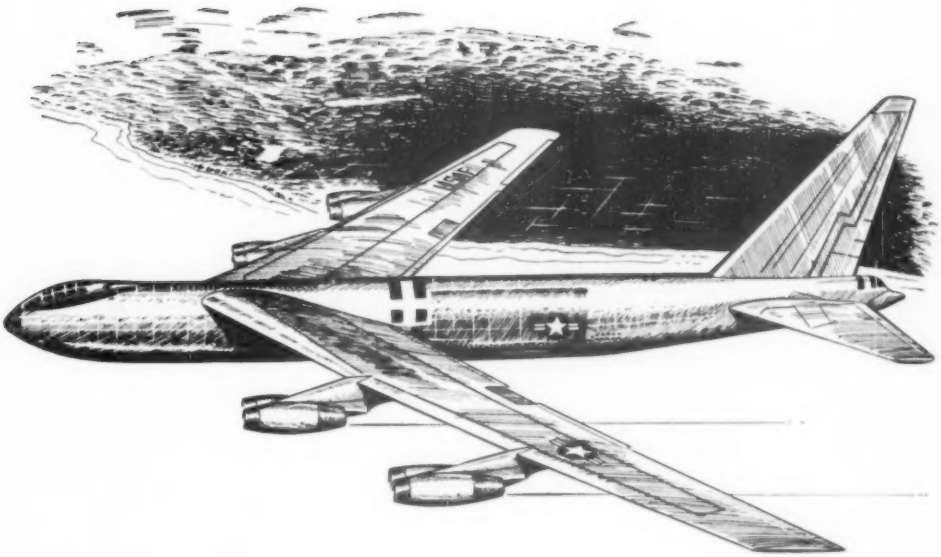
Progressing further with design leads to the advanced design concept, and this phase is not necessarily the ultimate. It involves not only the design of the airframe and the assumption of responsibility for integration of associated equipment, but also means contribution to the establishment of requirements for future basic airborne weapons, development of which is prompted by scientific advancement and geopolitical conditions.

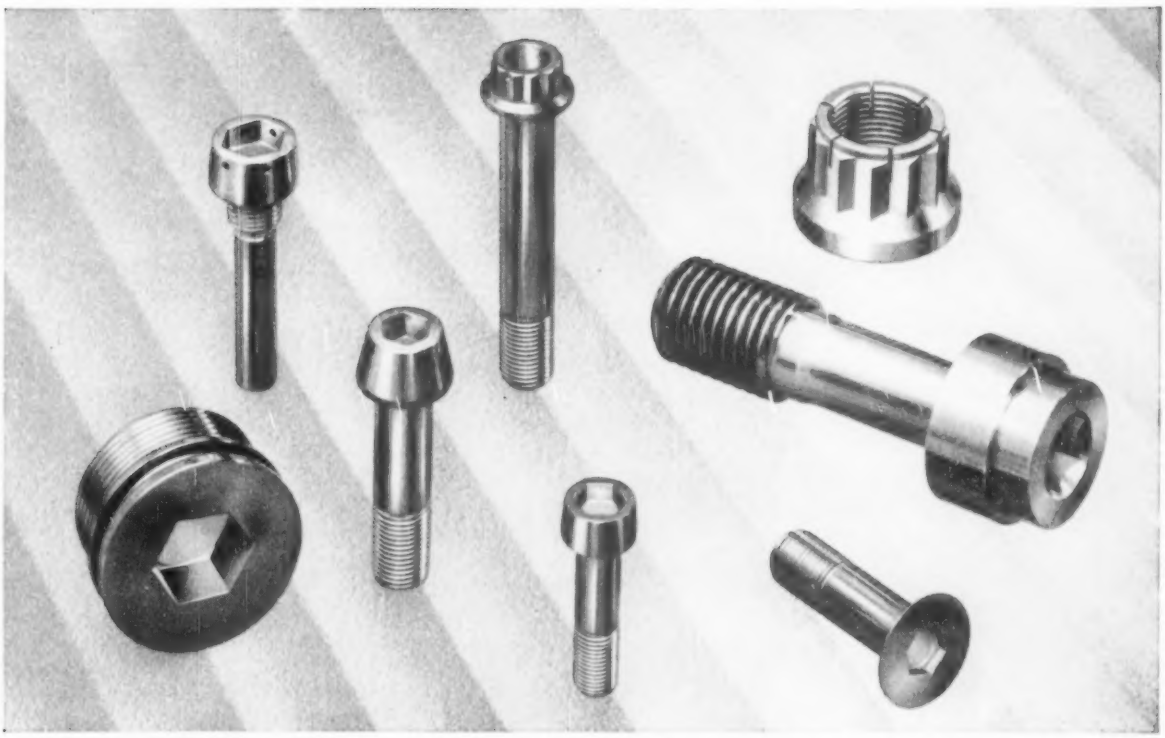
Martin's George Trimble emphasizes "contribution." He sees the situation as a two-way deal. The military knows how to fight a war, what its special needs are. The designer's contribution lies in helping ascertain what can be done to meet these requirements.

The intermeshing of these two functions with various dates as targets is the key to advance design achievements. Big point in the military-designer relationship is the establishment of mutual respect for each activity's function.

To implement this philosophy, Martin has set up its Advance Design group, with Trimble as team manager to understand, possibly anticipate, the problems of the military planners, and in some instances to come up with solutions which previously may have been considered "impossible."

Boeing B-52 Stratofortress uses SPS Precision Fasteners





A typical selection of SPS fasteners. For complete information, write STANDARD PRESSED STEEL CO., Jenkintown 3, Pa.

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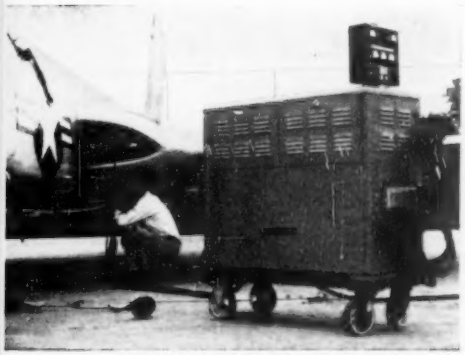
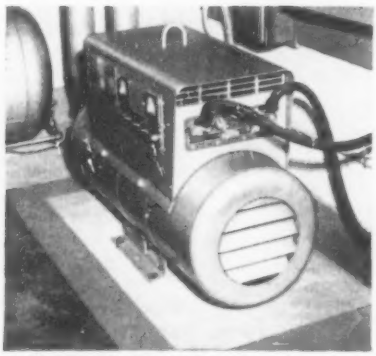


FREQUENCY CHANGER PACKAGES are available in 10-, 15-, 30- or 60-KVA ratings for the supply of 400-cycle power. Shown here in ground checking service, this unit is ideal for more accurate instrument and device testing or calibrating.



MOTOR DRIVEN UNITS, like this one in a jet engine test power room, are available in 265-, 500- or 1000-amp, 28-volt ratings. Suitable for mobile use or stationary installations, these units give you accurate and more reliable ground power.

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this—before turning any particular job over to the missile.

Reasoning behind the new approach: Man is still the most reliable mechanism of a complex nature.

• **AF aircraft development.** This activity is concerned mainly with advanced design studies for tactical weapons for the Air Force. One of these studies is a fighter-bomber configuration and represents a general category of design constantly under investigation at Martin to meet changing requirements.

The fighter-bomber of the past is viewed at Martin as only a revamped fighter. Advanced Design doesn't want to develop it along this line, but rather is looking at the type as in a special design category of its own.

Some immediate-future problems will have to get close attention. An aircraft that flies in rough air at low altitude and very high speed encounters frequent gusts—perhaps six per second. This means the structure will have to be designed from a fatigue standpoint so that it will have a normal life span despite the gusts; otherwise effective gust alleviation will have to be provided.

Cooling is another troublesome consideration for very highspeed, low-level flight. One view is that the highspeed condition may have to be limited to short periods. Another view is that cooling the pilot won't be too hard, but cooling of equipment will be a headache.

When unmanned vehicles return to denser atmosphere from very highspeed flight at very high altitude, the question of what to do with the heat generated raises a question—is it to be absorbed into the machine or put back into the air? Likely the solution will combine both.

A device such as some form of air brake could serve to partially dissipate the heat into the air. Some heat will have to be taken into the vehicle. The consideration here will be how much can be absorbed before it affects the machine. This, in the main, will be a materials problem.

Flight at very high speed at very high altitude, for manned and unmanned aircraft, introduces the very serious consideration of obtaining adequate stability about all three axes. One answer is artificial damping with an autopilot-type device, to oppose the initial moment.

• **3-D layout shop.** Martin's Advanced Design Department will make considerable use of the facilities of this layout shop, which builds full-size mockup sections of advanced designs that are under consideration. Materials used are inexpensive—cardboard, tape, wood—to obtain quick and economical configurations, equipment arrangements, packaging, and placement of personnel. Occasionally aluminum sheet is employed to enhance appearance. Cost of these mockups may run as little as 15% of a conventional mockups, it is reported.

Bunker Says . . .

Purpose of the Martin company's Advanced Design Department was outlined to Aviation Week recently by George M. Bunker, president of the airframe manufacturer. His comments follow:

"The Advanced Design Department of The Glenn L. Martin Co. was created recently as a natural step in keeping with the company's progressive policy of anticipating the technical requirements of future aircraft.

"The new department, headed by vice-president George S. Trimble, Jr., will determine the fields of aircraft creation and manufacture on which Martin will concentrate. One of the department's principal objectives is to anticipate military requirements in aircraft and to align Martin designs with those needs.

"The department, however, is not restricted to military activity. Exploration of new fields and studies in pure science may lead to valuable new developments of scientific nature. The department, for example, is making studies in gravity, nucleonics, rocketry and space flight.

"In opening these new areas of activity, Martin is not making a radical departure but is continuing its policy of sensitivity to the future needs of the industry."

► **Advanced Design Manpower**—The department's requirements and plans group, comprised of top-level personnel, is expected to expand from about three to approximately 15 people by the end of the year.

Under this top supervision, about 280 engineering and technical people—mostly Martin "veterans"—are working on active studies. This number is broken down into about 130 under direct supervision of Advanced Design and this group draws on approximately 150 from other technical departments—aerodynamics, electro-mechanics, etc.

The basic force of 130 is expected to grow to between 200 and 225 in the next 1½ years. In the same period the force of 150 drawn on from other departments is expected to jump to 225-250.

In addition to funneling more university talent into scientific research, Martin is going to expand its physical facilities—labs for both indoor and outdoor test—and segregate them from the main plants, probably close to Middle River for water access and supply.

► **Broad Scope**—George M. Bunker, Martin's president, emphasizes the big job laid out for Advanced Design: to anticipate military requirements of tomorrow and the day after, while at the same time probing for nature's basic secrets.

PRODUCTION BRIEFING

▶ **Bell Aircraft Corp.'s Helicopter Division,** Ft. Worth, has delivered three Model 47G copters to the Chilean Navy.

▶ **Kaiser Aluminum & Chemical Corp.,** Oakland, Calif., has developed a high-strength non-heat-treatable aluminum alloy, K186, for structural applications where heat-treatable alloys have been too costly or have inadequate physical or mechanical properties. K186 is said to be especially designed for welding, and is being produced in sheet and plate form as well as in a full range of tempers.

▶ **Chase Aircraft Co., Inc.,** Oakland, Calif., has leased a machine shop at Shipyard 3 in Richmond, Calif., for aircraft machinery storage. Chase is a subsidiary of Willys Motors, a wholly owned subsidiary of Kaiser Motors Corp.

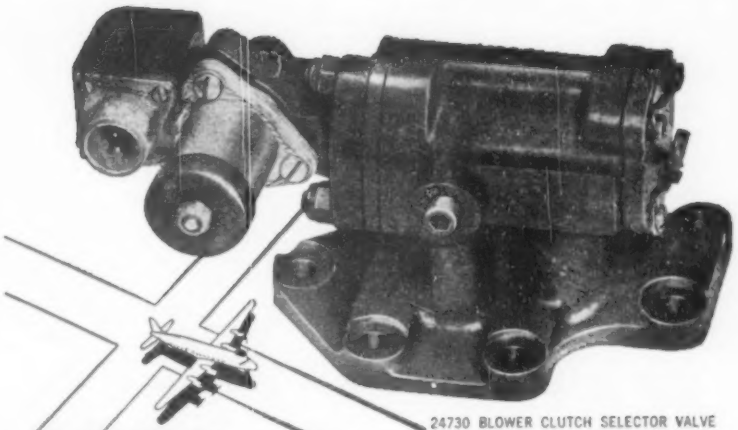
▶ **Accessory Overhaul Industries** has acquired fixed-base overhaul operations at Westchester County (N.Y.) Airport and is moving its Richmond Hill and New Cassel plants to the new location.

▶ **Pacific Helicopter Co.,** has been given a one-year lease for establishment of a copter maintenance and modification base at Metropolitan Oakland (Calif.) International Airport. PHC will service Bell and Hiller types and plans to expand its service to Sikorskys.

▶ **Convair,** Ft. Worth, Tex., has purchased for USAF a windtunnel instrumentation system that is said to make information available in 48 hours, cutting 43 days off time previously needed. Built by Consolidated Engineering Corp., Pasadena, Calif., the $150,000 installation, will be written off on the initial test for which the equipment is being purchased.

▶ **Rheem Manufacturing Co.,** has received a contract for over $1 million worth of heavy-duty shipping containers for Nike anti-aircraft missiles. Firm, which also produces Nike components, will make the containers at its Sparrows Pt., Md., and South Gate, Calif., plants.

▶ **Reynolds Metals Co.** plans to spend $2,585,000 to expand and modernize aluminum sheet mill facilities at Sheffield, Ala., including new furnaces and new buildings to house them. Each of five new melting units will have a capacity of 60,000 lb., with each of the holding units having a 40,000-lb. capacity.



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24730 BLOWER CLUTCH SELECTOR VALVE
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Weight: 2.2 lb.

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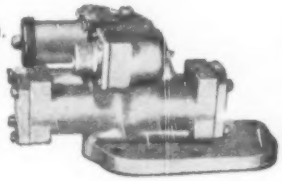
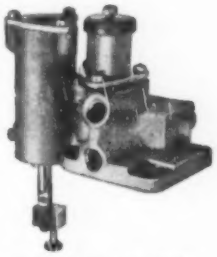
For use on Wright R3350-30 engine.
Provides positive control of two-speed supercharger with complete immunity to pressure surges in the operating fluid. Durable and dependable.
Weight: 1.75 lb.





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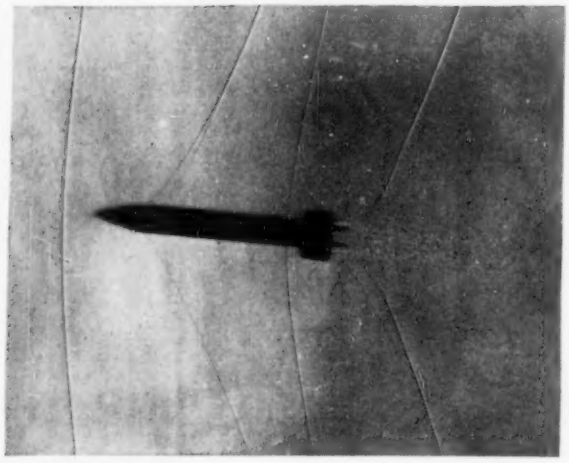
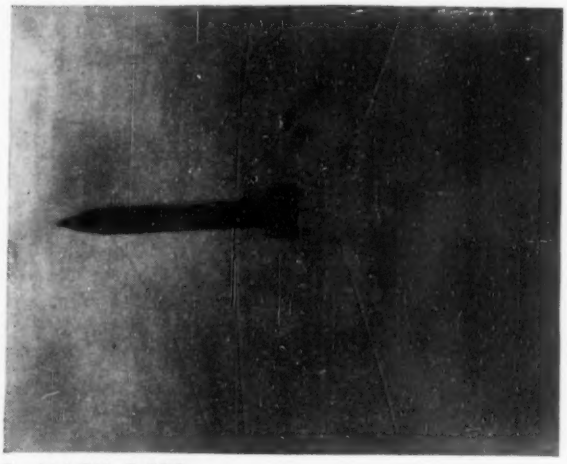
How Missile Decelerates Through



1. MACH 1.023



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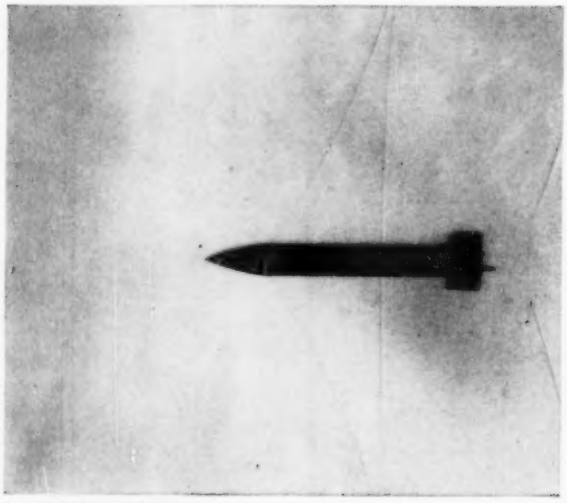

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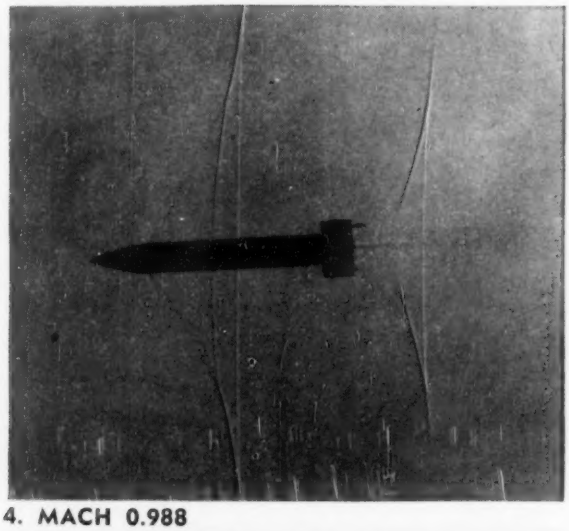

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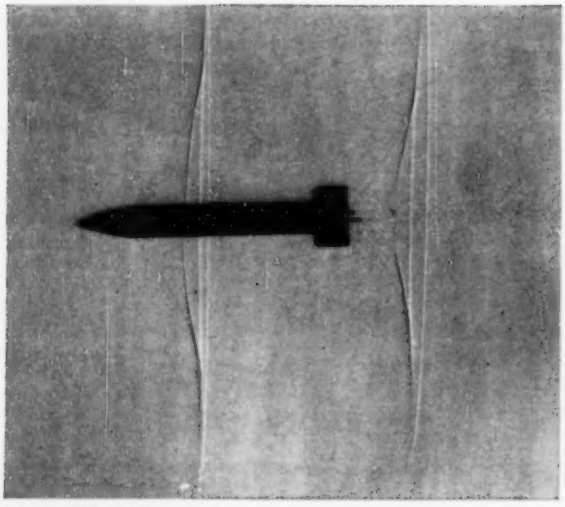

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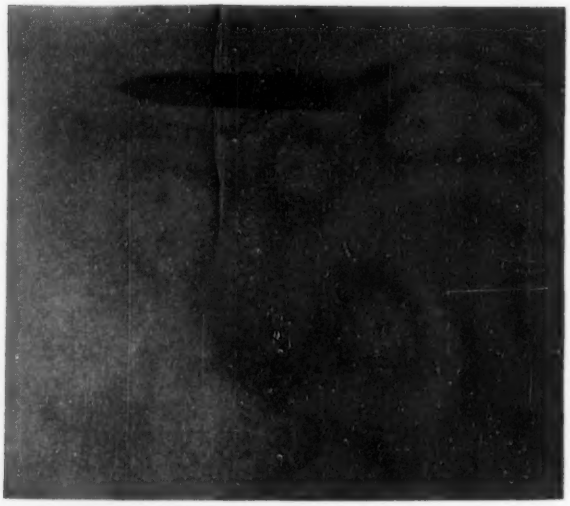

6. MACH 0.964

Sonic Speed

What happens when a missile or an airplane decelerates through sonic speed?

Some of the answers can be deduced from this remarkable series of high-speed spark-shadowgraphs, taken in the Pressurized Ballistics Range at the Naval Ordnance Laboratory, White Oak, Md.

The projectile is a typical cone-cylinder body 3.54 in. long, with a 0.39-in. diameter. It is stabilized by four rectangular wedge fins; the pins shown at the base of the model are for determining roll.

The ballistics range is a pressurized tube 318 ft. long, which permits firing of shapes such as these through air at any pressure from six atmospheres to less than 1/100 atmosphere.

The photos show how the shock-wave pattern moves forward and decays as the missile decelerates. What appears to be a double bow wave in the third picture, where the Mach number is exactly 1.000, is actually a reflection of the usual single wave from a mirror mounted near the photographic plate.

The boundary layer behavior can be clearly seen in the pictures; its thickness and location depends on the missile angle of attack and the pattern of the standing shock waves on the body. Successive frames show the changes as the missile rolls and yaws.

The curious saucer-like shock patterns on the body are also interesting; they are formed by the standing wave system and closed at the rear by a flow discontinuity which shows on these plates as a white line.

New Inventions

Government Offers Patents for License

New patents issued recently on inventions assigned to the U.S. in the field of aircraft and parts have been reported to AVIATION WEEK by the Government Patents Board.

These inventions are available for license, ordinarily on a non-exclusive royalty-free basis, on application to the agency indicated in the abstract. Printed copies of letters patent may be obtained from the Commissioner of Patents, Washington 25, D. C., at 25 cents a copy, payable by check or money order (stamps not accepted). Specify patent number and title when ordering.

▶ **AIRCRAFT IDENTIFICATION SYSTEM.** Patent No. 2,677,818, issued May 4, 1954.

An aircraft identification system for use in blind landings comprises a coding device

REDUCE Maintenance Costs

with a constant-speed AIRLINER MET-L-MATIC propeller by McCAULEY

The MET-L-MATIC propeller is unique in its class particularly because of its design details, which greatly *reduce maintenance costs.* Only the MET-L-MATIC propeller features a separator which prevents the balls of the main blade bearing from rubbing against one another. Bearing failures due to chafing and galling are eliminated and bearing friction is greatly reduced. As a result, the pitch change is *smooth and surge*-free. And the savings effected in bearing maintenance far exceed the slight initial cost of this separator in the MET-L-MATIC.

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No pitch-changing parts exposed to weather.

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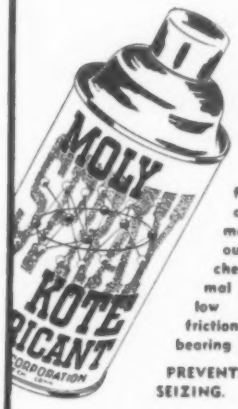

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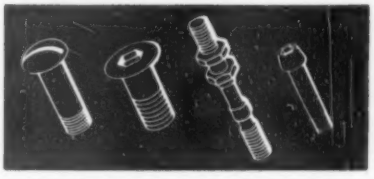

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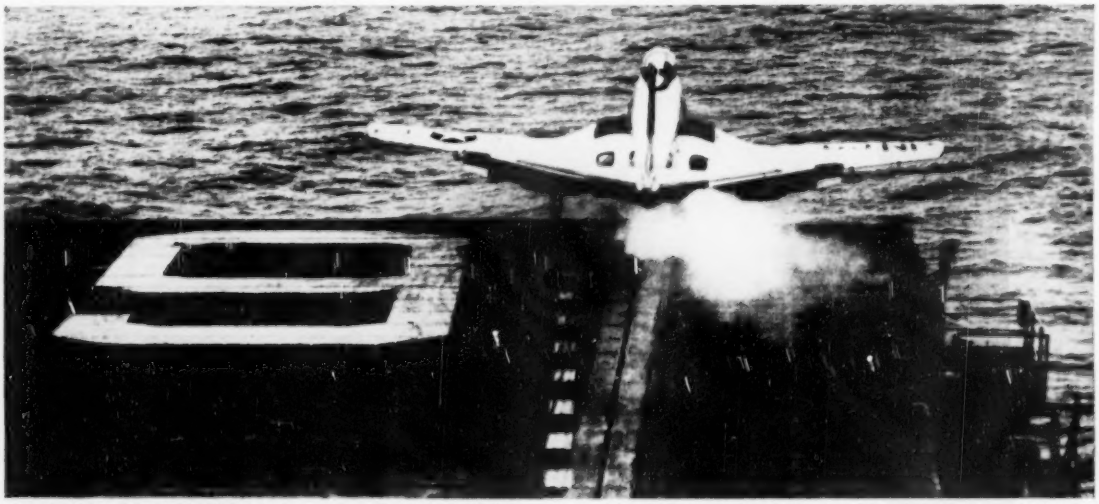
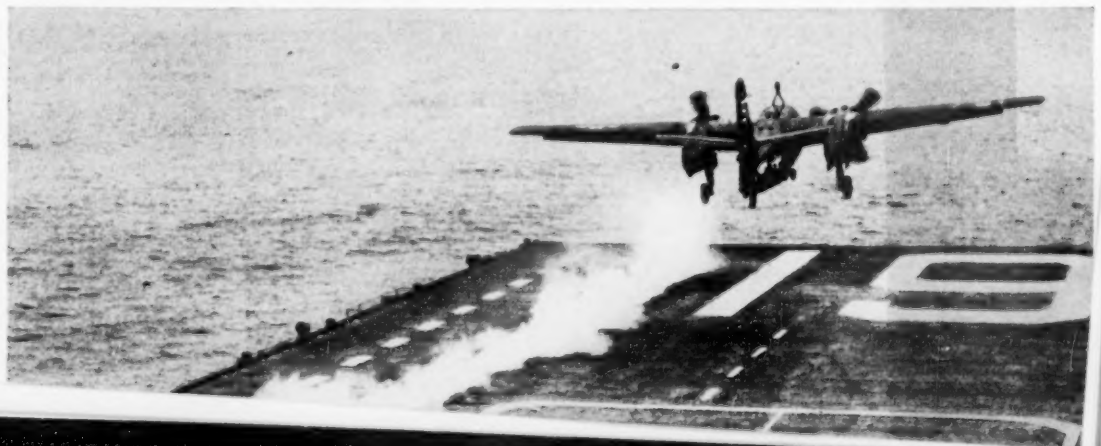
CHANCE VOUGHT F7U-3 CUTLASS takes off in a cloud of steam during tests of new catapult at Naval Air Materiel Center, Philadelphia. Navy plans steam catapults on 13 of its carriers, including Forrestal-class and ships presently equipped with hydraulic units.

Navy Plans Converting Carriers to Steam Catapults



McDONNELL F2H-3 BANSHEE is steam catapulted from USS Hancock, marking first time a jet fighter has been launched in this fashion from a carrier. Last December, a Grumman F9F-6 Cougar fighter was steam-launched from land-rigged catapult at NAMC, Philadelphia.

GRUMMAN S2F-1, piston-engine anti-sub plane, makes the first steam catapult take off from a carrier. Ship is USS Hancock. Termed the C-11 slotted-cylinder catapult, device was developed by the British and utilizes steam from ship's boilers. A water brake stops the piston.



You saw it in Aviation Week
Now here's the story behind the story

E. W. BLISS CO.
producing, field-testing and maintaining the new steam catapults

A task force of Bliss engineers is working closely with specialists of the Naval Air Material Center in production, testing and maintenance of the Navy's new C-11 slotted cylinder steam catapults—

- **At the prototype stage** Bliss and Navy men supervised testing of the steam catapults in both land-based tests at the Naval Air Material Center, Philadelphia, and aboard the USS Hancock, off San Diego. (See photos at left.)

- **Halfway around the world,** with the Pacific Fleet, Bliss technicians are traveling from carrier to carrier by helicopter—inspecting, testing, and supervising maintenance of newly-installed catapults.

- **Here at home,** other teams of Bliss engineers and technicians are burning the 2400 oil as they and Navy officials pore over production plans to equip the big Midway-class carriers to steam catapulting.

Production of catapult components is centered at Bliss' main plant—its 675,000 sq. ft. plant at Canton, Ohio. Here are headquartered the men, the machines and the catapult "savvy" to help the Navy go "full steam ahead" with its conversion program. Because of the size of this and the other five Bliss plants, this important catapult program and other classified projects can be absorbed without affecting Bliss' role as world's largest press builder, and as leading supplier of rolling mills and special machinery.

Carrier Catapult Conversion Begins in Canton. This aerial view shows Bliss' main plant at Canton, Ohio, where steam catapult manufacture is centered.

E. W. BLISS COMPANY, Canton, Ohio
Presses, Rolling Mills, Special Machinery

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MACHINE GUNS NAVAL GUN MOUNTS
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RADAR REFLECTORS
play a vital part

To find a target or locate survivors takes *accurate*, radar-assisted navigation. The reflectors that send and receive radar's telltale impulses perform a vital function. Parabolic shapes must conform exactly to DESIGN. Top-flight electronics manufacturers know that Lavelle facilities and techniques are unmatched in critical stainless steel and aluminum fabrication of this sort. Experience in this field has earned for Lavelle the reputation of a particularly well qualified and reliable sub-contractor.

Lavelle

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capable of a large number of independent variations. Each aircraft to be identified carries a lightweight beacon which is preset on the ground. The ground control system includes an interrogator which sends out a search pulse from a rotating directional antenna, the frequency of which may be varied, to provide coding. The aircraft beacon is adjusted so that it will respond to interrogation pulses only when the time delay corresponds to the time interval for which the beacon is preset. A ground identifier system analyzes the signal received from the airborne beacon. Inventor: Marcus D. O'Day. Administered by the Office of the Judge Advocate General, Department of the Army, Washington 25, D. C.

▶OBSTRUCTION RADAR SYSTEM. Patent No. 2,677,819, issued May 4, 1954.

A radar system for avoiding obstacles in the path of a moving vehicle such as an airplane comprises a pulsed transmitter and a receiver both operating in conjunction with control and indicating devices. The transmitter projects short pulses from the airplane. The pulses are reflected from any obstacle and the echoes are received, amplified and coupled to the control and indicating devices. These devices are adjusted so that when the obstruction is within a predetermined distance from the airplane, a warning signal is given so that the airplane can be steered to avoid the obstruction. Inventor: Robert L. Sinsheimer. Administered by the Patent Counsel, Department of the Navy, Washington 25, D. C.

▶AIRBORNE MOVING TARGET INDICATING RADAR SYSTEM. Patent No. 2,678,440, issued May 11, 1954.

A radar system for use in aircraft for distinguishing moving objects from stationary objects comprises means for generating and transmitting high-frequency pulses, a generator for producing reference oscillations synchronized in phase with the oscillations of the pulses and means for combining the echo oscillator signal with the echo signal. The signals derived from stationary objects will have constant amplitude but those from moving objects will vary in amplitude. The system includes a comparator for comparing the echo signals in an algebraic manner. The signals which change in amplitude will result in an output from the comparator and thus indicate moving targets. Inventor: Bob E. Watt. Administered by the Office of the Judge Advocate General, Department of the Army, Washington 25, D. C.

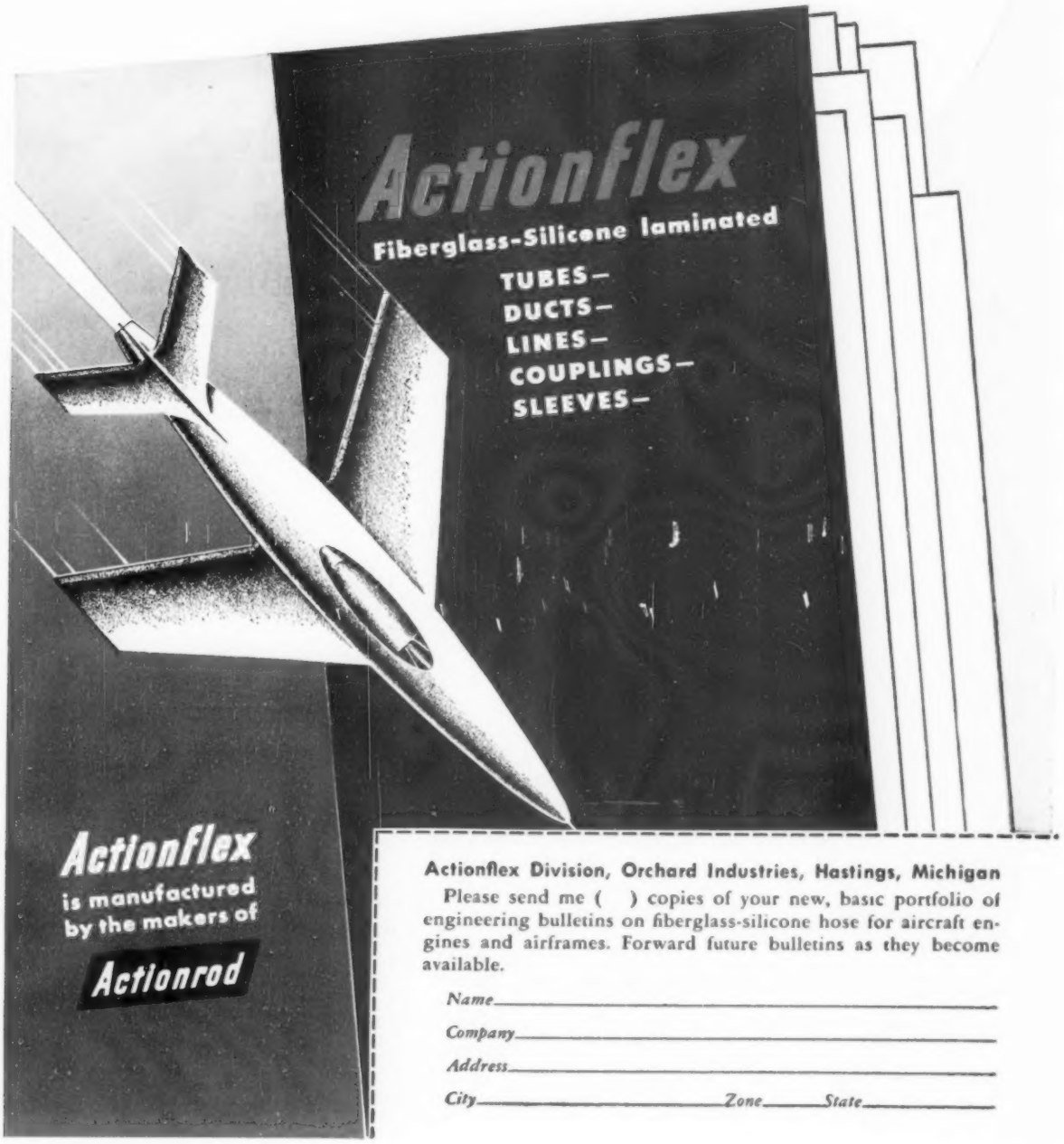
Aircraft Plants Win Higher Tax Writeoffs

Revision of tax amortization procedures by the Office of Defense Mobilization now permits rapid tax writeoffs on a higher than normal percentage for companies locating defense plants in sections classified by the Labor Department as having a substantial labor surplus.

The policy revises one issued last November that permitted accelerated tax amortization for firms locating de-

To Keep Up To Date . . .

on new developments in Actionflex fiberglass-silicone laminated hose for aircraft, start your file now with this new, basic portfolio of engineering and product bulletins. It will be sent to you by return mail and future bulletins will be forwarded automatically. Just use the handy coupon.



Actionflex Division, Orchard Industries, Hastings, Michigan

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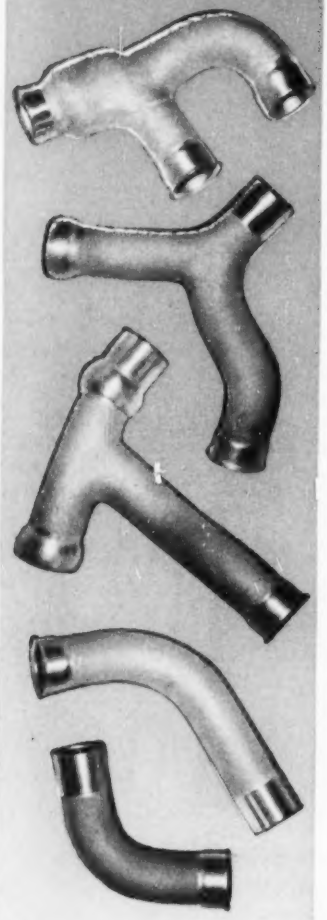
1 ENGINEERING

2 DEVELOPMENT

3 PRODUCTION



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fense facilities in areas with a chronic labor surplus.

ODM says that of the 240 expansion goals established since the Korean war, about 150 have been reached through the construction of facilities required for defense production.

Certificates of necessity and the percentage allowed for accelerated tax amortization awarded Sept. 9-22 include:

Robertshaw-Fulton Controls Co., Anaheim, Calif., aircraft control valves, $17,673 certified with 55% allowed.

G. A. Gray Co., Cincinnati, special machine tools, $250,000 certified with 45% allowed.

Hughes Tool Co., Culver City, Calif., aircraft parts, $87,777 certified with 65% allowed.

Ex-Cello-O Corp., Highland Park, Mich., aircraft engine parts, $209,724 certified with 65% allowed.

Douglas Aircraft Co., Santa Monica, Calif., military aircraft, $292,553 certified with 65% allowed.

Maks Machine Co., Van Dyke, Mich., aircraft components, $50,658 certified with 70% allowed.

Lord Manufacturing Co., Erie, Pa., aircraft parts, $84,244 certified with 70% allowed.

Fairchild Engine & Airplane Corp., Aircraft Division, Hagerstown, Md., military airplanes, $96,000 certified with 40% allowed.

American Machine & Foundry Co., Electronics Division, Boston, military electronics, $4,699 certified with 65% allowed.

Magnus Tool & Die Co., Newark, N. J., aircraft parts, $175,000 certified with 45% allowed.

Bendix Aviation Corp., Utica Division, Utica, N. Y., aircraft components, $156,539 certified with 40% allowed.

Lear, Inc., Grand Rapids, Mich., flight instruments, $31,538 certified with 65% allowed.

Lockheed Aircraft Corp., Burbank, Calif., military aircraft, $75,145 certified with 65% allowed.

Stiger Precision Products, Inc., Chicago, aircraft components, $27,741 certified with 70% allowed.

Fenwal, Inc., Ashland, Mass., scientific instruments for defense, $7,649 certified with 70% allowed.

Northrop Aircraft, Inc., Hawthorne, Calif., military aircraft, $64,398 certified with 65% allowed

Rohr Aircraft Corp., Chula Vista, Calif., aircraft components, $103,000 certified with 55% allowed.

United States Rubber Co., Mishawaka, Inc., aircraft parts testing facilities, $137,220 certified with 70% allowed.

Texas Instruments, Inc., Dallas, electronic equipment, $36,081 certified with 70% allowed.

Kearfott Manufacturing Corp., Newark, N. J., aircraft electronic equipment, $91,884 certified with 70% allowed.

Solar Aircraft Co., San Diego, aircraft engine components, $67,000 certified with 40% allowed.

Land-Air, Inc., Alamogordo, N. M., military electronic products, $3,158 certified with 65% allowed.

Glenn L. Martin Co., Baltimore, military aircraft, $26,000 certified with 60% allowed.

Solar Aircraft Co., Des Moines, Iowa, aircraft components, $85,392 certified with 65% allowed.

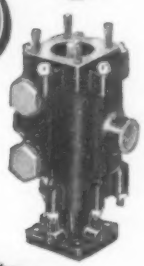
Boeing Airplane Co., Seattle, military aircraft, $359,887 certified with 65% allowed.

Bendix Aviation Corp., Pacific Division, North Hollywood, Calif., military electronic controls, $138,682 certified with 65% allowed.

Curtiss-Wright Corp., Propeller Division, Caldwell Township, N. J., aircraft components, $48,386 certified with 65% allowed.

Bendix Aviation Corp., Pacific Division, Burbank, Calif., military electronic controls, $74,706 certified with 65% allowed.

Pioneers of New Frontiers



Beyond the blue . . . up to the star-flecked blackness that surrounds the earth . . . and at speeds that leave sound behind! Vital to the jets pioneering these new frontiers of aviation are CECO Engine-Driven Gear Pumps . . . high performance main and emergency fuel pumps for the world's most advanced engines. Whether for turbo-prop or turbo-jet engines, CECO gear pumps assure accurate control of fuel flow for peak power and dependability.

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DIVISION NILES-BEMENT-POND COMPANY

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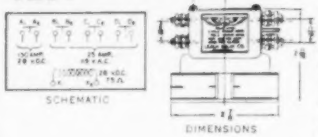
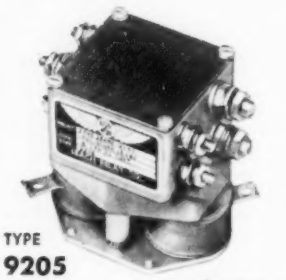
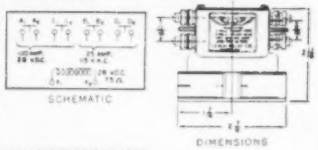
TYPE **9204**





TYPE **9205**



OPERATING CHARACTERISTICS

RATING:	RATING:
5P-NO, 150 Amps. @ 29 VDC. 3P-NO, 25 Amps. @ 115 VAC, 400 Cycles.	2P-NO, 100 Amps. @ 29 VDC. 2P-NO, 25 Amps. @ 115 VAC, 400 Cycles.

CONTACTS: 4PST—DB-NO
COIL: 24-28 VDC, continuous duty.
Pick-up 18 VDC max.
Drop-out 7 VDC max.
Temperature range −55°C to +120°C.
WEIGHT: 1.2 lbs. approx.

In airborne electro-mechanical components, *Leach* high quality makes the difference. Whether you're racing with sound up in the stratosphere or making a final approach to a landing strip at sea-level, it's reassuring to know that you have the most efficient, most reliable controls built. It is for this reason that more military and commercial aircraft incorporate *Leach* Relays and Contactors than any other make. They are produced to rigid aircraft standards.

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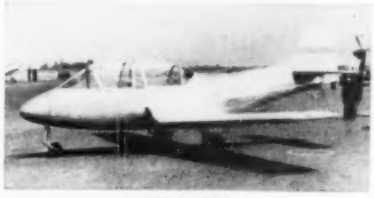
OVERSEAS SPOTLIGHT

SIPA 200



SIPA 300

Argentina Buys Tiny Jet

PARIS

Argentina is awaiting delivery of the Sipa 200 Minijet, believed to be the smallest jet trainer in the world. Two prototypes of the Minijet have been built, and five more are under construction. The model pictured above shows some changes from the original prototype, notably in squaring of the tail.

Powerplant is a Turbomeca Palas jet giving about 350 lb. thrust.

Testing is well advanced on another Sipa trainer, the 300, which is also powered by a Palas engine. Prototype of this tandem-seat trainer was shown to NATO officials at recent air show at Villacoublay.

Float or Fly

LONDON

Travelers between London and Sweden may now fly one way and go by ship the other and still be granted roundtrip discount by both services.

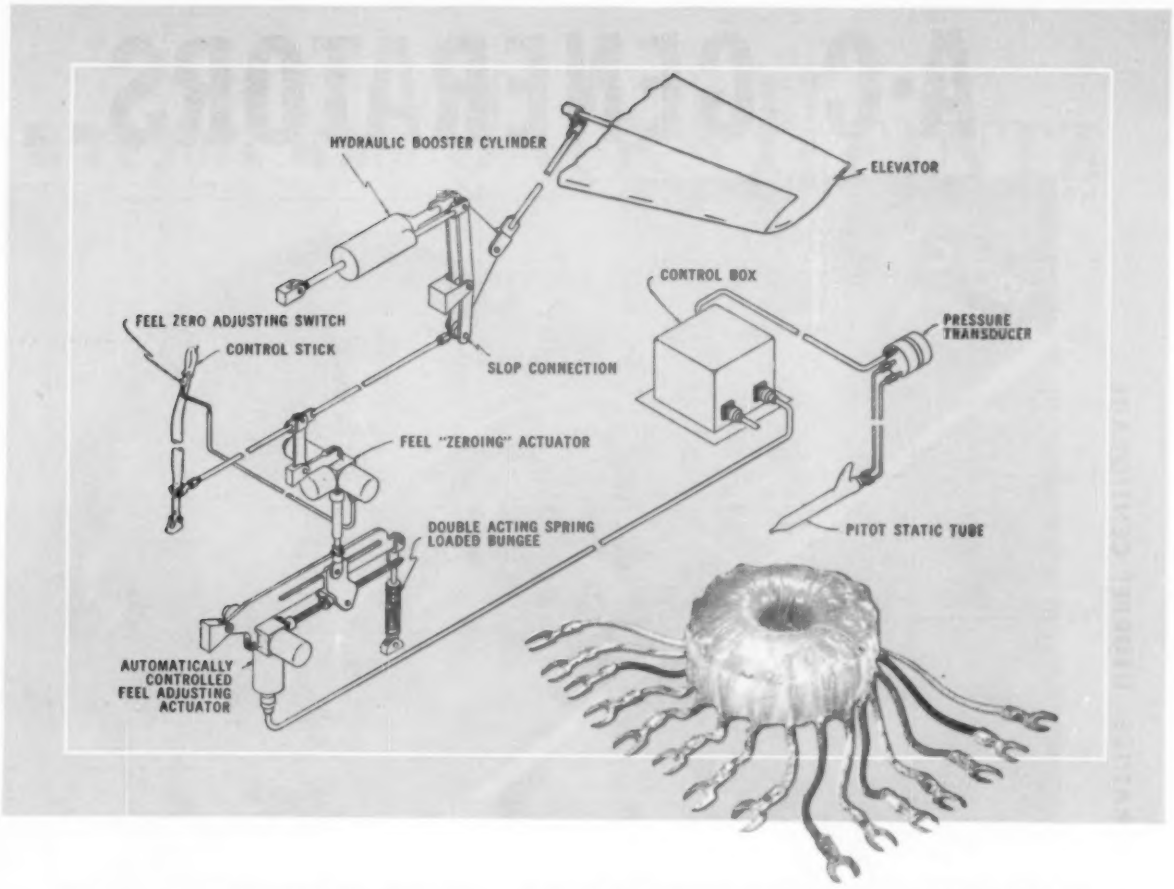
This combined air-sea arrangement is the result of an agreement between Swedish Lloyd Steamship Co. and Scandinavian Airlines System.

Magic Carpet Flies Again

TEL AVIV

Magic Carpet, the airborne operation which brought about 130,000 Jews to Israel from Yemen and Iraq in 1949-1951, is in business again.

This time the project aims to provide transportation to Israel for part of the 100,000 Jews in troubled North Africa. The immigrants are brought by steamship to Marseilles from Morocco, Tunis and Algeria. Then El Al flies them to Lydda.



OUR PET OCTOPUS AMPLIFIES SERVO SIGNALS

This saturable reactor has more in common with its namesake than appearance. It's durable, long-lived, and awfully hard to hurt.

In a control system utilizing artificial "feel," our Octopus works this way: Air pressure on the control surface is recorded by the pitot tube, and translated in turn by the transducer into a weak electrical signal. The Octopus, in the control box, boosts the signal sufficiently to operate the control system actuators. And we point out, with proper modesty, that the actuators — like the Octopus itself — are Airborne-designed and manufactured.

The Octopus depends neither on fragile vacuum tubes nor delicate relays. It is a simple toroidal winding around a finely laminated magnetic core. It operates efficiently even at the highest temperatures, and when fixed in a thermo-setting compound, it is impervious to shock.

If you have problems in the control system category, or questions about the Octopus, call on us.

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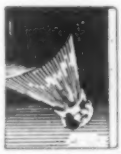
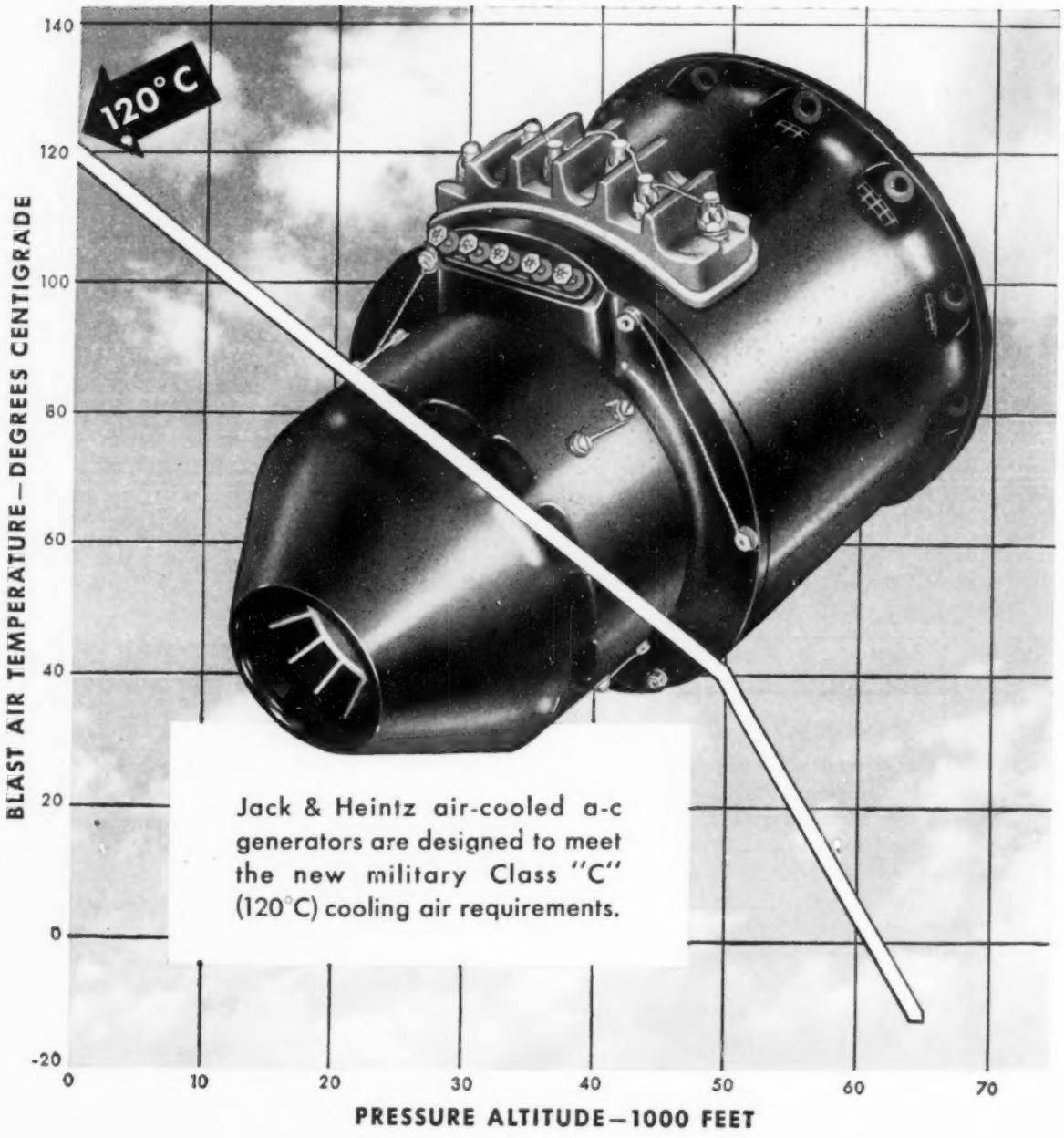


COMPLETE INFORMATION
on the Airborne line of electro-mechanical actuators is contained in our new aviation catalog. Send for your copy today.

A-C GENERATORS...



Jack & Heintz air-cooled a-c generators are designed to meet the new military Class "C" (120°C) cooling air requirements.

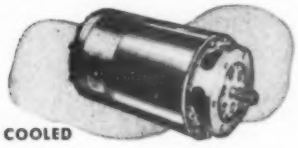
JACK & HEINTZ *Rotomotive*

a report from JACK & HEINTZ

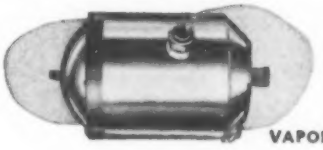
New thermal designs give J&H generators wide range of applications

Jack & Heintz air-cooled a-c generators will operate in 120°C environmental conditions. Improved thermal design, including the use of high-temperature insulating materials and increased handling capacity of cooling air, makes this possible. For more severe environmental conditions, Jack & Heintz has developed oil-cooled, vapor-cooled and thermal-lag machines.

Environment-Free Generators



OIL COOLED



VAPOR COOLED

JACK & HEINTZ A-C GENERATORS FOR HIGH-PERFORMANCE AIRCRAFT

	AIR COOLED				OIL COOLED		VAPOR COOLED		THERMAL LAG
Nominal Rating	20 kva	30 kva	40 kva	120 kva†	20 kva	40 kva	12 kva	30 kva	8 kva
Specification(Ref)	MIL-G-6099	MIL-G-6099	MIL-G-6099	MIL-G-6099	MIL-G-6099	MIL-G-6099	J&H	J&H	J&H
Drawing	J&H G284	J&H G282	J&H G281	J&H G180	J&H G192	J&H G190	J&H G75	J&H G188	J&H G186
Volts	120/208	120/208	120/208	120/208	120/208	120/208	120	120	120/208
Speed	6000	6000	6000	6000	8000	6000	12,000	12,000	12,000
Phase	3	3	3	3	3	3	3	3	3
Frequency	400	400	400	400	400	400	400	400	400
Power Factor	0.75	0.75	0.75	0.75	0.75	0.75	0.8	0.8	0.9
Weight	67	75	86	250	95*	165*	46	66	42
Moment	270	370	400	2100	1100*	2250*	270	475	230
Length	14.18	15.86	16	22	23.5	27.25	10.69	13	13
Diameter	11	11	11	11	11	13	9	9	8
Mounting and Type	AND10266 XVI-A	AND10266 XVI-A	AND10266 XVI-A	AND10267 XVII-C	AND10266 XVI Spl	AND20006 XVI Spl	AND20002 XII-E	AND20002 XII-E	AND10262 XII-A

*Includes weight of constant speed drive.
†Blast air temperature limits of MIL-G-6099 apply.

Military specification numbers as used herein are for purposes of product identification only and do not necessarily imply specification conformity.

Jack & Heintz engineering personnel and manufacturing facilities are geared to undertake design and production of complete a-c systems or individual components. We invite your inquiry. Write Jack & Heintz, Inc., 17635 Broadway, Cleveland 1, Ohio.

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AIRCRAFT EQUIPMENT

Litton Aims for Major Role in Avionics

• Thornton speeds growth in components and systems field by purchases of 'small blue chip' firms.

By Philip Klass

GENERAL STAFF of Litton, under Tex Thornton (head of table), has ambitious plans.

Beverly Hills—Charles B. (Tex) Thornton, former assistant general manager and vice president of Hughes Aircraft Co., together with several other former key HAC people is out to build "one of the top dozen advanced electronics companies in the nation." Several prominent Wall Street investment houses are "betting" that Thornton and his associates can do it.

The new enterprise, called Litton Industries, with headquarters in this residential suburb of Los Angeles, is concentrating on both precision components and systems engineering and is already a major supplier in the avionics field. Thornton is president and chairman of the board of the new company. He is also on the board of directors of the Radio & Electronic-Television Manufacturers Assn.

▶ **Buying Small Blue Chips**—In the year since Thornton and his associates left Hughes, they have been quietly buying up what Thornton likes to call "small blue chips"—companies with an outstanding product or with technical know-how in fields which Litton wants to enter. First such purchase was Litton of San Carlos, Calif., one of the nation's biggest producers of airborne radar magnetrons, from which the new company took its corporate name. (Thornton switched from an earlier name, Electro Dynamics Corp., because of a conflict with a similarly named division of General Dynamics.)

Despite the fact that Litton Industries is less than a year old, present employes number 650 and its annual sales rate is running around $7 million, figures which Thornton expects to increase to nearly 1,500 and $20 million by the end of next year. However, sales volume could jump as high as $50-100 million if several negotiations now pending go through.

Litton's financial backing comes from Lehman Bros. and other Wall Street investment houses under a rather unusual arrangement which gives Thornton and his associates complete voice in directing the new company's activities. This confidence in Litton's management is based, at least partially, on the reputation which Thornton built during his five years at Hughes.

▶ **More Than Amalgamation**—While Litton has been buying up small companies it has also been assembling a staff of technical experts here in Beverly Hills to develop new proprietary items and systems. Under H. W. (Bill) Jamieson, Litton vice president and staff engineer and formerly co-director of the Hughes radar labs, the company now has a group of professional scientists numbering around 50 to give it know-how in radar, fire control, computers, navigation and guidance, and nuclear electronics.

Some of Litton's current developments which can be disclosed include radar systems employing the new monopulse techniques, electronic countermeasures equipment, automatic flight controls, data handling machines, and new microwave components such as ferrite gyrators (radar load isolators.)

▶ **Promising New Addition**—The recent purchase of a small computer company, called Dico, may enable Litton to revolutionize the digital computer business despite its late entry into an already crowded field. The Dico group

HEADQUARTERS in Beverly Hills has 165,000 sq. ft. of office, lab, and factory area.

The Litton Story

Litton Industries and Ramo-Wooldridge, two lusty newcomers in the avionics field, were set up in the last year by former top personnel of Hughes Aircraft Co.

Philip Klass, Aviation Week's Avionics Editor, studied these two companies during his recent stay on the West Coast. Last week in this space he analyzed Ramo-Wooldridge's growth and potentialities. This week he tells the Litton story.

GOOD MEN
and
GOOD IDEAS

CAST LONG SHADOWS

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AC DEFENSE PRODUCTS

GM

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The effect of good ideas can be felt the length and breadth of the land – particularly ideas in research, development and production for defense.

Such ideas are rare. But, AC is proud of the many it has already contributed, and the part they have already played in America's defense through the T-38 Skysweeper, the A-4 Gun-Bomb-Rocket Sight, the Bombing Navigational Computer and others, many of which may not be mentioned here.

AC's people and AC's ideas have already cast a long shadow. But, this is only a beginning. The AC organization, with a group of more than 700 highly trained engineers, is rapidly forging to the very front of the electro-mechanical field.

If you would like a hand with an electro-mechanical problem of your own, why not give AC a call?

DEFENSE PRODUCTS of High Quality at Low Cost DELIVERED ON TIME

Bill
Fink

What's behind the Broken Records?

They're coming so fast now they hardly make news. Records are made for speed, height, capacity – then smashed in short time by another newer, bigger commercial airliner. Back of these broken records is *brute power* – developed by ever greater, better engines . . . engines that *must* be protected against damaging heat and friction. Sinclair is proud of the part its Aircraft Oil plays in protecting these engines. *Today, more than 45% of the oil used by major scheduled airlines in the U. S. is supplied by Sinclair* . . . Proof positive of dependability.

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THE "SKYRAMA"...

is an entirely new concept of the executive custom-built airplane deluxe. It combines great beauty and luxurious appointments with careful emphasis on cockpit layout and crew comfort, in addition to extraordinary maintenance features designed to save the owner time and money. The "SKYRAMA" is super-sound proofed throughout, including the pilot's cabin . . . is scientifically ventilated and equipped with four extra large panoramic windows, affording an unexcelled view in all directions. The Douglas DC-3 is recognized as the world's *most service tested* and *safest* airplane . . . The "SKYRAMA" is the last word in the modernization of this great airplane . . . MASTER CRAFTSMANSHIP FROM TIP TO TAIL.

THE "SKYRAMA" IS DIVIDED INTO THREE EXQUISITE SECTIONS

1. The "SKY-ROOM" . . . a carefully engineered and *completely new* re-manufactured nose makes possible *for the first time,* the sensational new "SKY-ROOM," with its deluxe observation compartment for four passengers *directly behind the cockpit* . . . separated by plexiglass, it *is possible to observe the crew in action* and *have the same broad panoramic view ahead it enjoys* in addition to the full view observation through the large passenger windows on each side... NEW–SENSATIONAL–DESIRABLE!

2. The "SKY-CABIN" ...an ultra quiet secluded compartment, for six passengers, with divans comparable to the finest for sleeping or relaxing... four large 17"x17" full view windows... circulating fresh air, indirect fluorescent lighting and radio speaker reception.

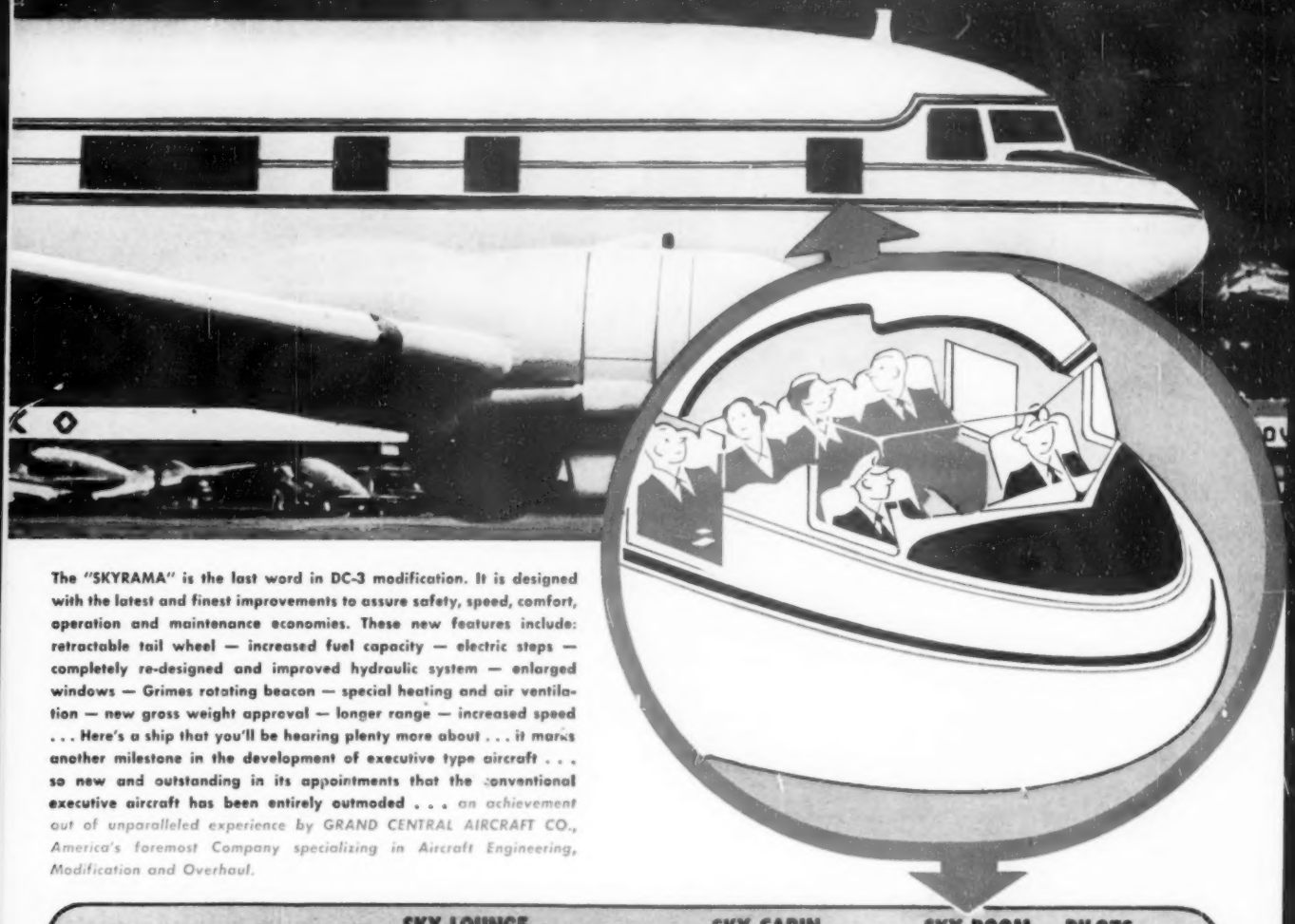
3. The "SKY-LOUNGE" . . . restrained modern decor with maximum comfort, convenience and great beauty . . . luxurious appointments for nine passengers that include: executive desk – radio and telephone . . . movable lounge chairs – reclining and swivel . . . window loge with unexcelled view through 17"x56" panoramic windows . . . last word in modern buffet styling– with cabinets and utilities . . . together with wardrobe, luggage and generous storage.

GRAND CENTRA

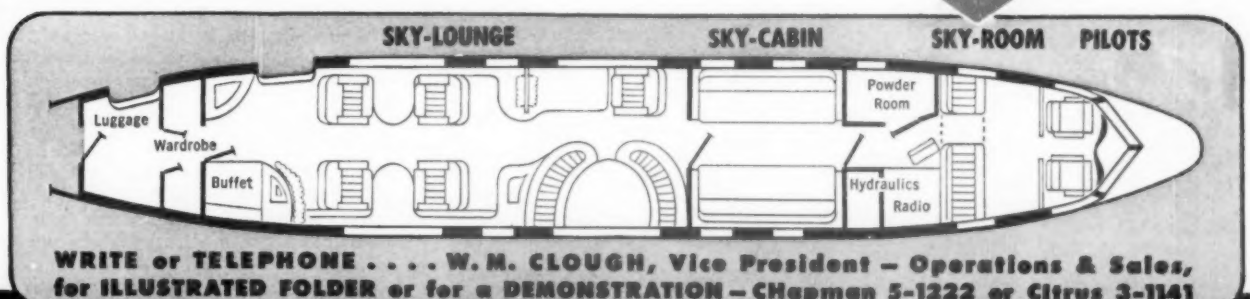
GRAND CENTRAL AIR TERMINAL . . . GLE

SKYRAMA

NEW SENSATIONAL "SKY-ROOM"



The "SKYRAMA" is the last word in DC-3 modification. It is designed with the latest and finest improvements to assure safety, speed, comfort, operation and maintenance economies. These new features include: retractable tail wheel — increased fuel capacity — electric steps — completely re-designed and improved hydraulic system — enlarged windows — Grimes rotating beacon — special heating and air ventilation — new gross weight approval — longer range — increased speed . . . Here's a ship that you'll be hearing plenty more about . . . it marks another milestone in the development of executive type aircraft . . . so new and outstanding in its appointments that the conventional executive aircraft has been entirely outmoded . . . *an achievement out of unparalleled experience by GRAND CENTRAL AIRCRAFT CO., America's foremost Company specializing in Aircraft Engineering, Modification and Overhaul.*



WRITE or TELEPHONE . . . . W. M. CLOUGH, Vice President — Operations & Sales, for ILLUSTRATED FOLDER or for a DEMONSTRATION — CHapman 5-1222 or Citrus 3-1141

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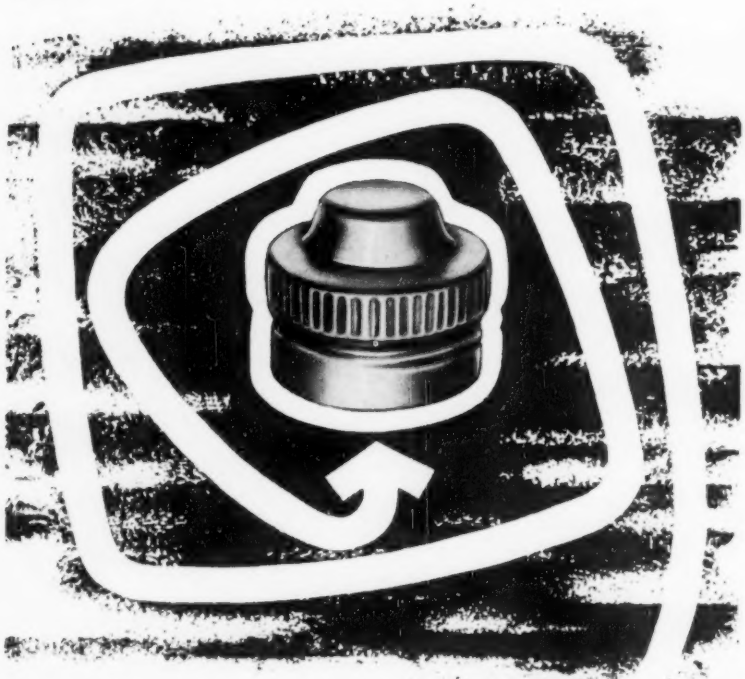

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is headed by Floyd Steele, who has reportedly devised radically new design techniques which will cut digital computer complexity, size, and cost by a factor of 10-20.

During the recent Wescon meeting, Steele delivered a paper in which he revealed that Dico had built a 20-integrator digital differential analyzer using only 14 vacuum tubes and 180 diodes, and occupying only one cubic foot. He estimated that a 200-integrator machine could be built with only 20 tubes. This is a small fraction of number of components and size previously required (AVIATION WEEK Sept. 27, p. 70).

If the cost, size, and complexity of digital computers can be reduced by a factor of 10-20, Thornton believes that a vast new market will open up for the machines.

► **Buying Time and Talent**—"In purchasing small blue chip companies, we are buying time and first-class engineering talent," Thornton says. This will enable Litton to be profitable and self-sustaining from the start. "We have no wealthy angel," Thornton points out.

This does not mean that Litton looks solely at a company's current profit and loss statement. Litton has turned down the chance to buy several firms whose present profit position looked good and purchased several whose position was a bit rocky. The latter, Thornton believed, had top-notch products which Litton's management, business, and technical skills could turn into profitable operations.

► **Components for Diversification**—Seeking an optimum amount of diversification, Litton concluded that the precision components business provides such a base. With many customers among equipment manufacturers, a cutback in any one equipment program has little effect on business. The field also looked attractive because "engineering provides a large lever over quality," Jamieson points out.

Litton decided that the precision potentiometer field offered attractive possibilities, went out and hired top people from three pot manufacturers, including the sales manager from one.

Meanwhile, the Birklan Co. of Mt. Vernon, N. Y. had developed machines and techniques for winding precision potentiometers with a very high degree of linearity (to within 0.02%), but had not been able successfully to market its product. This company's financial backer, a non-electronics firm, had already invested several hundred thousand dollars and was reluctant to put up more.

After Litton's experts had investigated the company's product, Litton bought the firm, including patents and facilities, and hired its staff. Thornton believes that Litton now has the top

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product in the precision pot field and is actively exploiting it.

By a similar path, Litton is now producing a line of low-cost precision metal film resistors with a tolerance of 1%, designed for high-temperature operation.

▶ **Cross-Pollenization**—Litton sees several advantages to combining precision components and systems engineering activities under one corporate roof. For one thing, the components business can help to support the company for a year or two until equipment developments reach the production stage.

Equally important, Jamieson believes, is the cross-pollenization effect between the two. For example, the design of new equipments frequently forces engineers to develop new components, which can then be exploited commercially.

New developments in components frequently open up new systems techniques previously considered impractical for lack of suitable components Jamieson points out. Monopulse radar is one example he cites in which recent component developments have opened new vistas.

The company's systems engineering work should give it "a feel for the end product market and show what new components are needed," Jamieson adds.

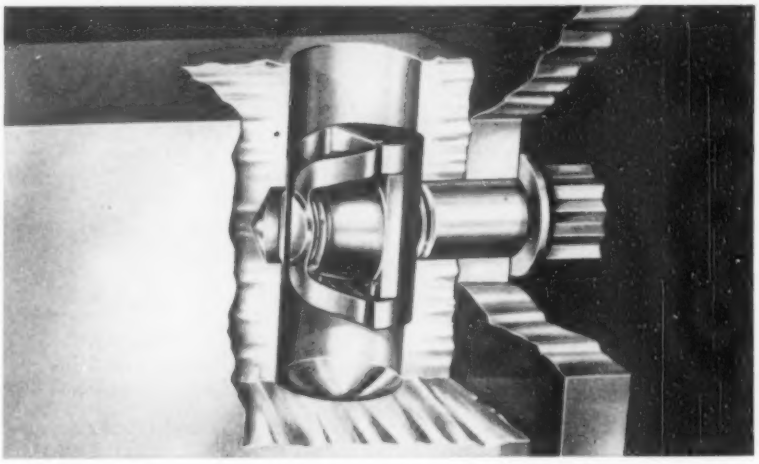
The company expects to develop its own proprietary components in fields requiring a high degree of engineering and/or manufacturing skill. In addition to ferrite gyrators, Litton has already developed delay lines and broadband rotary joints for waveguides.

▶ **Scope of Operations**—Some idea of the ambitious scope of Litton's present and anticipated activities can be gained from the company's divisional breakdown:

- **San Carlos Power Transmitter** (microwave tubes, including magnetrons and klystrons).
- **Precision Components** (pots, resistors and delay lines).
- **Microwave Components** (gyrators, waveguides, rotary joints).
- **Radar Systems** (surveillance and traffic control radar, ground and airborne radar beacon systems).
- **Automatic Flight Control.**
- **Communication & Navigation** (UHF, VHF and microwave systems, inertial navigation systems).
- **Computers & Control.**
- **Research Laboratory.**
- **Special Test Equipment** (test and instrumentation equipment).
- **Nuclear Electronics.**

▶ **Electrodata Machines** — AVIATION WEEK talked with George Kozmetsky, Jack Thorne, and Serge Fomenko, all former HAC people now in the Computers & Control division. Kozmetsky and Thorne head the division. Of the

FASTENER PROBLEM



Reducing weight and saving time in joining major substructures

Use of a hex shaped or 12 point type nut to join major aircraft substructures and components means two costly, time-consuming operations: 1) end-milling bathtub recesses to provide adequate wrenching area, and 2) precision drilling mating bolt holes . . . and an accompanying high percentage of misalignment rejections. A simplification of these fastening operations has long been an objective of every major American aircraft manufacturer.

ESNA type 2552 is the newest and most efficient solution to this problem. **First,** the shape of the nut fits into a simple drilled hole . . . the nut does not have to be held for wrenching. The bathtub recess for the nut is completely eliminated. In many cases this permits major reductions in the size and weight of the forging or structural members to be joined because edge distances can be reduced.

Second, a floating action of .030", perpendicular to the axis of the bolt hole, is designed into the nut. As a result misalignment rejections are virtually eliminated and production economies result from working to the normal tolerances required for installation.

Barrel design eliminates need for wrenching area. "Floating" principle eases close tolerance requirements and compensates for misalignments. Shown without clip.

Third, a steel clip is offered which snaps on the nut and when the unit is inserted into a drilled hole it locates and holds the nut in the proper position to receive the bolt.

Fourth, to meet the tensile requirements of these critical applications this nut develops 180M psi at the pitch diameter of the bolt.

Fifth, type 2552 is made lighter in weight by using an aluminum alloy cradle to support the nut body.

Sixth, this new high tensile floating barrel nut uses a red nylon locking collar to guarantee vibration proof, self-locking performance and extended re-usability.

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SAN CARLOS division (l.), which produces precision magnetrons (above) and klystrons, looks more like a lab than factory. Litton is among the top makers of magnetrons for airborne radar.

three, one is a Harvard Business School graduate, another is an electrical engineer, and the third a physicist and mechanical engineer, an indication of the diverse talents needed in the electrodata machine business. One suggested that they might all be classed as "management scientists."

Working with Floyd Steele's Dico group in San Diego, Kozmetsky says that Litton hopes to develop a group of building blocks from which a variety of automatic production, process control, and business machine systems can be assembled. Litton will concentrate on the military and scientific computer fields first, later the business fields, Kozmetsky indicates.

▶ **Background for Leadership** – The backgrounds of the men who presently head the operating divisions show considerable diversity, although most have technical experience and degrees. For instance, Dr. Norman Moore, company vice president and managing director of the San Carlos division is a PhD in physics. Dr. Sidney Frankel, head of radar systems, has a BS in electrical engineering, his PhD in math. Campbell, who heads precision components, has a BS in physics, is a Harvard Business School grad, but came up through manufacturing and sales.

This is in keeping with Thornton's philosophy: the best man for the particular job, regardless of his background. Thornton himself is not an engineer, although he studied engineering for two years before switching to business administration.

During the war, Assistant Secretary of War for Air Robert A. Lovett brought Thornton into the Air Force to apply modern business management techniques to military operations. Thornton set up a statistical control department (later called the controller's office) which today is standard throughout the Defense Dept. Thornton, now 41, was at one time the youngest colonel in the War Department.

After the war, Thornton became director of planning for Ford Motor Co., returning to the government on occasion for special assignments.

▶ **Move to HAC**—When Thornton joined Hughes in 1948, his assignment was to apply the same modern management techniques to the then-mushrooming avionics company which had been operating in the red. He brought in Roy L. Ash, a financial expert and Harvard Business School grad, as chief comptroller. Ash is now a Litton vice president, its chief financial officer and member of the board of directors.

When Thornton and Ash left Hughes Aircarft, it had become the second most profitable business in the Hughes empire, and was grossing around $200 million a year.

▶ **Thornton's Philosophies** – Recognizing that some companies are dominated by people with sales or engineering backgrounds, others by manufacturing people or financiers, Thornton believes that no single group should be dominant in the kind of operation that Litton plans. When a supervisory job needs filling, Thornton plans to pick the best man available, regardless of his formal training or background.

Thornton also believes strongly that engineers and scientists should not have to become administrators and leave behind their technical work in order to gain financial recognition. He points to Sig Hansen, in Litton's research lab.

Hansen, formerly co-head of the storage tube section in Hughes' electron tube lab, is a prolific inventor with dozens of patents to his credit. He would far rather invent than supervise or direct others, Thornton says.

Litton has a stock bonus plan for key personnel which gives them part ownership in the enterprise they are helping to build. This is one way of repaying non-managerial technical personnel.

In hiring engineers and scientists, both Thornton and Jamieson emphasize that they usually seek men who are one or two tiers below engineering management in their present positions. "We want men who are still technically creative and haven't gotten rusty in engineering," Thornton says. This philosophy also assures that there will be room for these men to rise in Litton management, if they so desire.

▶ **First Blue Chip**—The first company which Thornton acquired was no stranger to him. Several years earlier Hughes had had trouble getting a satisfactory 250-kw. magnetron for its radar, until Litton came into the picture. The original company trying to produce the maggies was having extremely high scrappage during manufacture and high failure rates in service.

Litton Engineering Labs of San Carlos, then a small company of 40 employes specializing in machinery for building tubes, offered to build the magnetrons for $400 on a fixed-price contract, despite the fact that the other company was having trouble building them for $550. Litton not only amazed HAC people by producing a far superior tube, but it voluntarily cut its price to $275, Thornton says.

In three short years, Litton grew to nearly 400 employes, upped its annual sales to around $4 million, and became the country's largest producer of precision magnetrons, Thornton says.

Thornton purchased the San Carlos operation from Charles Litton, the firm's founder, with the latter retaining a small independent facility which develops and makes glass lathes, vacuum pumps and ion gages.

▶ **San Carlos Operation**—A visit to the San Carlos plant, and a talk with Dr. Norman Moore, its managing director, explains why it has been able to establish a pre-eminent position for quality and low cost. With nearly 400 employes, a staff of only 17 people handles

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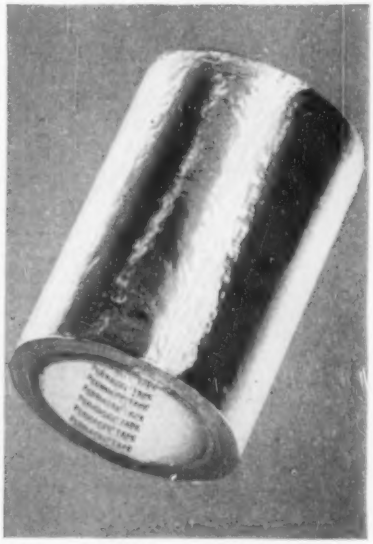

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all such overhead functions as payroll, accounting, personnel, purchasing, sales, and advertising. Dr. Moore points out that San Carlos prefers, and actually insists upon, fixed-price contracts to keep down its accounting and auditing overhead.

The 77,000-sq. ft. plant is spotlessly clean, neatly laid out. Each production program has its own open stock bins for accumulating and drawing of all raw materials, eliminating considerable bookkeeping.

▶ **Look, No Inspectors!**—A most unusual feature, particularly for a manufacturer of precision devices, is that San Carlos has no inspectors. Each worker inspects his own output, recording his findings on a master card which accompanies every magnetron from initial assembly through final test.

This policy, plus such things as profit sharing for all employes and free coffee, clearly pays off. San Carlos gets better than a 90% yield on its magnetrons from raw material through to finished tested items.

In 1952, reports from the field indicated that 4J52 magnetrons, made by seven different manufacturers including Litton, were failing in some instances after only 10 hours of use, despite rigid factory tests. Moore and Litton visited the air bases to make a first-hand analysis of the trouble. One factor, they concluded, was that tests used by the magnetron industry did not reflect rugged field conditions.

They built a dynamic cycle-life tester which subjects magnetrons to a varied duty cycle, including two different pulse lengths, while the VSWR is continuously varied. For the past year and a half, every maggie built at San Carlos has been subjected to 500 hours of cycle life test. The tubes themselves have been improved to the point where, after 500 hours of this simulated field-use, they still meet "start-of-life" specification and tube stability is actually improved.

The entire magnetron industry is now using this 500-hour cycle life test, Moore reports. He also says that other maggie producers, including Bell Labs, have sent representatives out to see the San Carlos operation and pick up a few pointers.

▶ **Only Recently Unveiled**—Several months ago, Litton's systems engineers needed a magnetron of a type which San Carlos did not make so they made inquiry at General Electric. GE's representative was surprised because he knew of Litton only as a competitive magnetron manufacturer. What he, and most of industry, did not know until recently, was that the new Litton Industries is now operating in many fields of electronics, including complex systems engineering.

Only recently has Thornton taken the wraps off Litton's operation to show a company with 300,000 sq. ft. of facility, including 165,000 sq. ft. at the Beverly Hills headquarters.

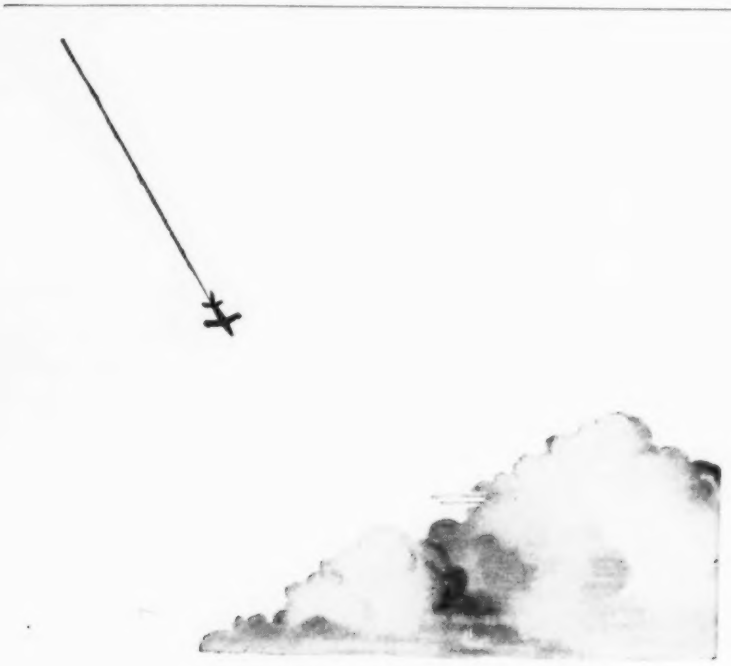
Even since AVIATION WEEK visited Thornton, the company has acquired controlling interest in West Coast Electronics Co., communications, test equipment and components manufacturer. The new addition will continue operation, at least for the present, under its own name.

Thus, Litton Industries is seen as a firm with ambitious plans and ample financial backing. It clearly bears watching.

NBS System Pinpoints Blade Temperatures

A gas-turbine blade temperature "telemetering system" which eliminates normally used sliprings and brushes as well as thermocouples has been announced by the National Bureau of Standards. The new system can be used to measure temperatures up to at least 1,400F with an accuracy better than ±25F, at turbine speeds up to 25,000 rpm. and at centrifugal forces up to 100,000G, according to a report from NBS.

The NBS system substitutes induc-



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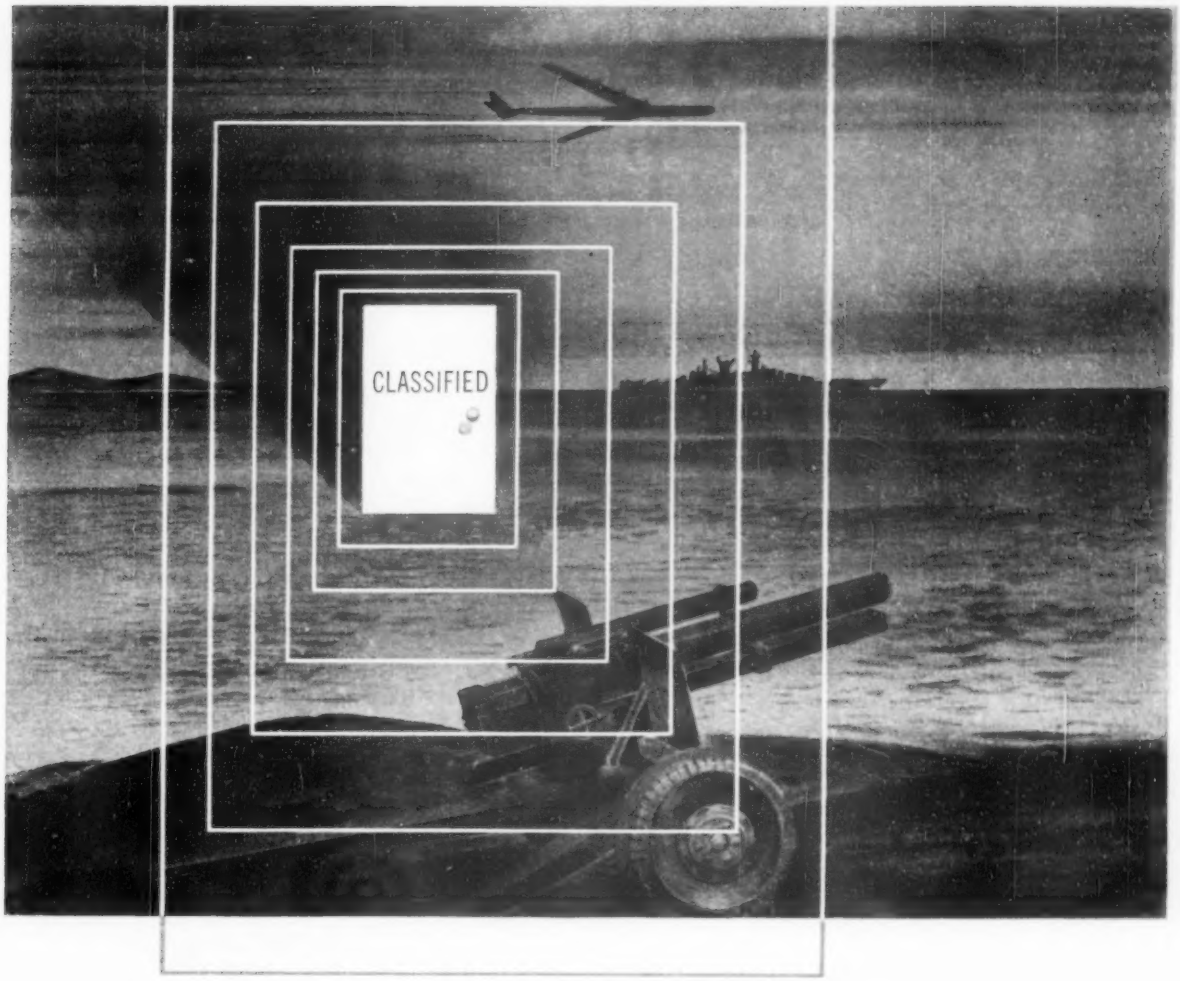

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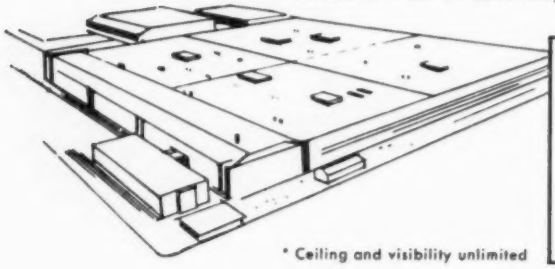

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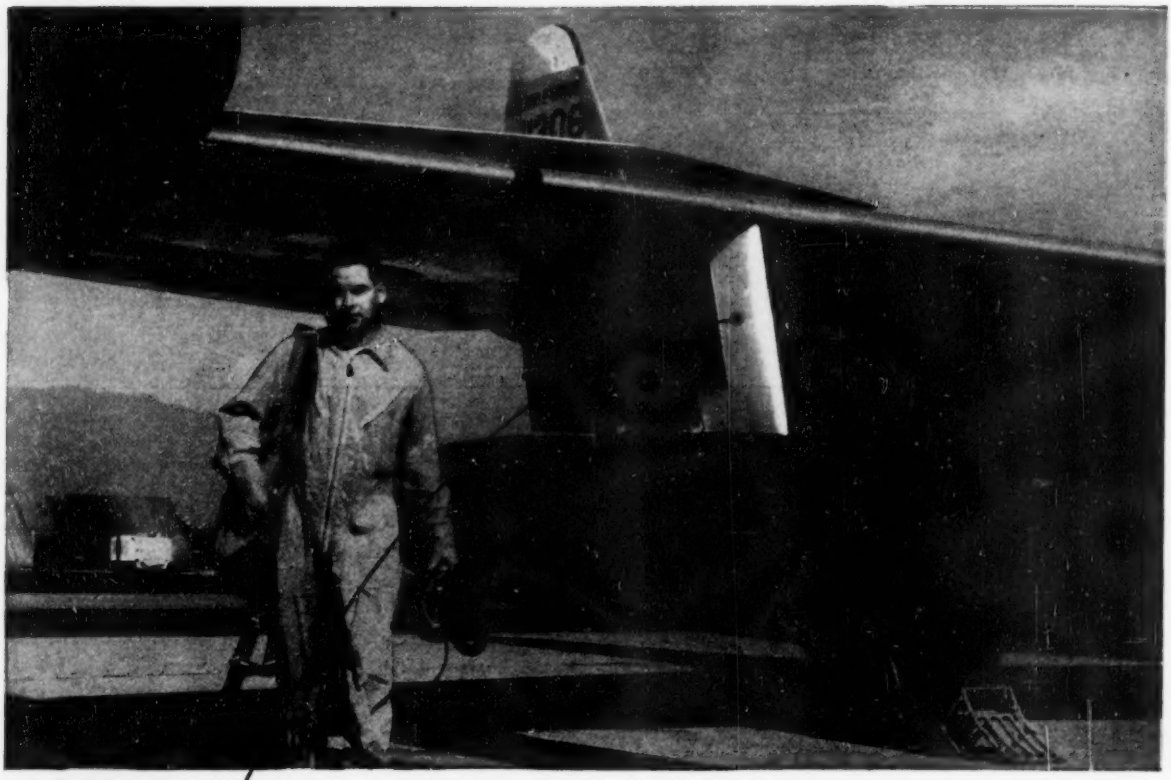

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complete aircraft anti-icing and de-icing systems, assemblies, and components . . . designed . . . engineered . . . manufactured

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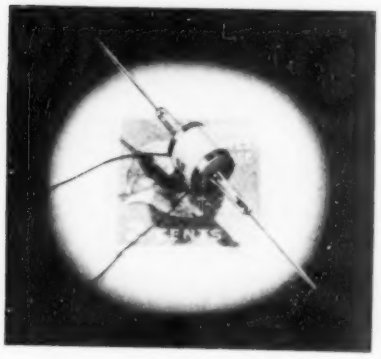
tive pick-offs, eliminating the problem of poor contact between brushes and slipring at high rotor speeds. A stationary coil, excited from a low radio frequency source, transfers energy to a rotating coil on the turbine rotor which in turn feeds a resistive temperature element attached to a turbine blade. The amount of energy transmitted inductively back to a second stationary coil is a function of blade temperature.

The technique, developed under Navy BuShips sponsorship, is described in NBS Summary Technical Report No. 1877.

Industry Reports New Miniaturized Devices

A new relay, smaller than a postage stamp, is one of several recently announced miniaturized components designed to allow avionic designers to cut their equipment size and weight.



The relay, called "Magseal," requires only 18 milliwatts to operate, has sealed contacts. Unit comes in variety of sizes, with more than 100 contacts if required. Manufacturer is Electromechanical Div., G. M. Giannini & Co., Inc., East Orange, N. J.

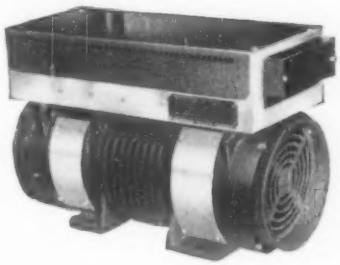
Other miniaturized components include:

• **Sub-min precision pot,** wire wound, only ¼ in. dia., is available in resistances of 200 to 50,000 ohms, with linearities of 0.3%, or closer on special order. Unit is rated 2 watts for 60C rise and designed for operation between −55C and 125C. Manufacturer: Ace Electronics Associates, 125-129 Rogers Ave., Somerville 44, Mass.

• **Linear motion transducers** are available in 32 models with linear displacement ranges of 0.003 to 2 in., for operation from a variety of voltages and frequencies. Subminiature models have a sensitivity of 2.5 mv./mil/volt input. Transducer for 0.003-in. displacement measures only ¼ in. dia. x ½ in. Manufacturer: Minatron Corp., 13 Cliveden Place, Belle Mead, N. J.

• **High-Q capacitors,** Type TSG, employing Teflon instead of mica insula-

The most complete line of AIRCRAFT INVERTERS



The Red Bank Division of Bendix Aviation Corporation is the logical place to find your answer to aircraft inverter needs—and for three significant reasons. First, we offer the widest range of inverters. Second, we design and build each inverter as a complete, unified mechanism. Third, we are equipped to design and produce inverters for all kinds of special-purpose applications . . . and, in fact, are now engaged in developing inverters up to 5000 VA and for high temperature, high altitude applications. Our current production models are described below. For complete details on these and also on special-purpose designs, write Aircraft Inverter Section, Bendix Red Bank Division, Eatontown, N. J.

INVERTERS—400 CYCLE OUTPUT

Type Number	INPUT Volts	INPUT Amps	OUTPUT Volts	OUTPUT Phase	OUTPUT VA Rating	Approx. Weight Lbs.	Max. Alt. Feet	Designed to Government Part No.
12128	27.5	1	26	1	6	2.2	35000	AN3496-1
12126	27.5	2	26	3	10	2.3	35000	N1020-SK
MG-54	27.5	22	115/200	1	250	17	65000	E-5109
				3	250			
12142	27.5	22	115	1	250	13	35000	N-17158 Navy
				3	250			
12146-1	27.5	22	115	1	250	13	35000	53B6239 AF
12146-3	27.5	22	115	1	250	13	35000	—
				3	250			
MG-60	27.5	22	115	1	250	17	50000	53B6239 AF
MG-62	27.5	22	115	3	250	17	50000	AN3532-2
32E01	27.5	35	115	1	500	25	50000	AN3533-1
				3	500			
32E00	27.5	45-54	115	1	500	34	50000	AN3534-1
				3	750			
MG-57	27.5	100	115/200	1	1250	42	50000	E1737-1 Navy
				3	1500			
MG-61	27.5	100	115	1	1500	56	65000	53C6767
MG-64	27.5	100	115	3	1500	56	65000	—
MG-70	27.5	105	115/200	1	1500	56	65000	—
				3	1500			
1518 Mod. 1 & 2	27.5	130	115	1	1500	37.5	20000	—
				3	1800			
1518 Mod. 5	27.5	130	115	1	1500	37.5	35000	—
				3	1800			
32E06	27.5	180	115/200	1	2250	56	50000	E1725 Navy
				3	2500			
32E03	27.5	160	115	1	2500	61	50000	53B6227
32E09	27.5	180	115	1	2500	56	50000	—
				3	3000			

NOTE: D.C. Input voltage shown is a nominal value of 27.5 volts, but all units are designed to operate from 26 to 29 volts. Input amperes shown are values at 27.5 volts input.

Manufacturers of Special-Purpose Electron Tubes, Inverters, Dynamotors, Voltage Regulators and Fractional HP D.C. Motors.

Bendix Red Bank

DIVISION OF Bendix Aviation Corporation

EATONTOWN, N. J.

West Coast Sales and Service: 117 E. Providencia Ave., Burbank, Calif. • Export Sales: Bendix International Division, 205 East 42nd St., New York 17, N. Y. Canadian Distributor: Aviation Electric Ltd., P.O. Box 6102, Montreal, P. Q.

LONDON—Sabena Belgian Airlines recently linked England with Europe by an experimental helicopter flight, first ever made from the center of Brussels to the center of London. One of the airlines' Sikorsky S-55 passenger helicopters flew the cross-channel route in 2 hours 45 minutes, landing at London's South Bank heliport.

ANTARCTIC—Flying over ice-choked seas, S-55 helicopters from the Argentine Navy recently rescued 20 men virtually marooned for the past two years on Graham Land peninsula. The Sikorskys, operated from the deck of an Argentine transport vessel, made six round trips to bring the stranded men to safety.

AROUND THE WORLD WITH SIKORSKY HELICOPTERS

JAPAN—One of eleven Sikorsky S-55 helicopters built for Japan is pictured above being test flown with new flotation gear. This model is for Japan's official Maritime Safety Agency. Other Sikorsky S-55s are being delivered for service with air and ground branches of that country's National Safety Agency and Maritime Safety Agency.

INDIA—Civil purposes such as crop dusting or spraying, illustrated above, will be one major mission of three Sikorsky S-55 helicopters being delivered to the Indian Air Force. Because of their rugged dependability and large cargo capacity, versatile Sikorskys are in wide use for military and commercial purposes around the world.

TEXAS—Once more relief and rescue from flood hazards came with the whirling rotors of Sikorsky helicopters, this time during early summer floods along the Rio Grande River in southwest Texas. In one big airlift alone, thirteen H-19s from Gary Air Force Base at San Marcos, carried 266 passengers from a railroad train stranded by the flood at Langtry. They flew precious drinking water and vital supplies to isolated areas, lifted victims from the torrent and marooned people to safety.

SIKORSKY AIRCRAFT

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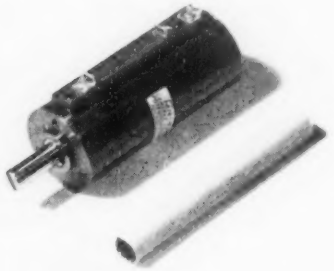
tion, reportedly have a Q which is three to five times greater than mica capacitors. The new TSG capacitor is available in 29 ratings and sizes, from 0.0004 microfarads, 6,000 v., to 0.001 microfarads at 24,000 v., is 80% smaller than other capacitors designed for same purpose, manufacturer says. Units operate up to 100C, meet JAN-C-5, types E, F, and G, electrical specs. Condenser Products Co., 140 Hamilton St., New Haven, Conn.

• **Ten-turn pot.** Type 920, measuring only 1 in. dia. x 2½ in. long, is available wound to accuracies of 0.25%, or up to 0.1% on special order. Resistance range



is 4,000 to 200,000 ohms, starting torque is 1 oz. in. and running torque is ½ oz. in. Fairchild Camera & Instrument Corp., Robbins Lane, Syosset, L. I., N. Y.

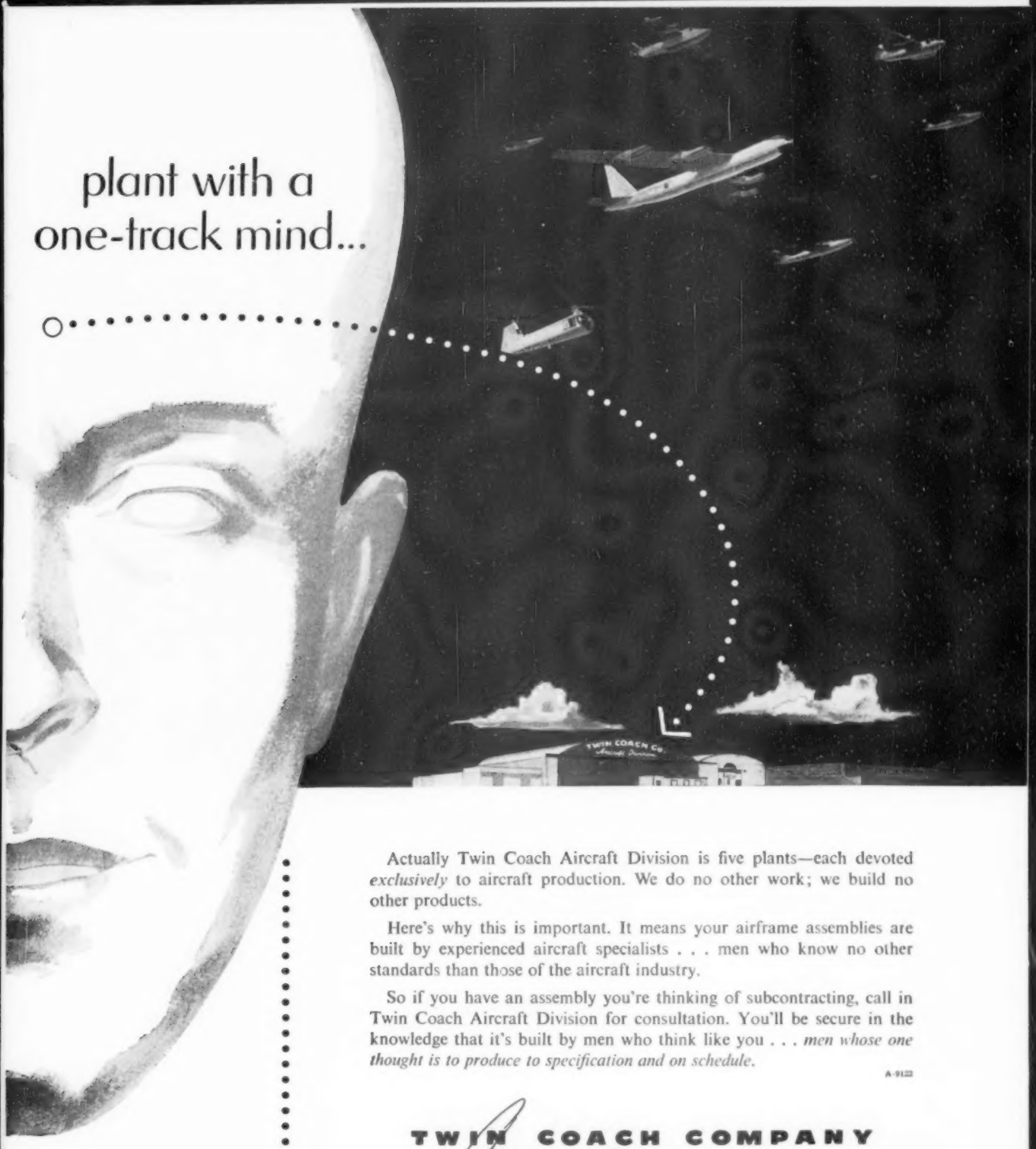
FILTER CENTER

▶ **Inertial Navigation Problems**—Despite considerable effort and emphasis on the development of inertial navigation systems suitable for long-range missiles at North American Aviation and elsewhere, observers say a satisfactory system still is at least several years away.

▶ **Ceramic Tube to WADC**—Eitel-McCullough will soon deliver 100 pilot-run samples of its rugged high-temperature ceramic receiving tubes (Aviation Week June 28, p. 61) to Wright Air Development Center for evaluation tests. Several avionic equipment manufacturers and one airline are also buying samples of the new tube.

▶ **Lear Switching To Mag Amplifiers**—All new autopilots, yaw dampers and similar servo systems coming out of Lear in the future are expected to use magnetic amplifiers throughout. Company policy is to eliminate vacuum tubes in servo systems by using magnetic amplifiers now, later substitute transistors for tubes in its communications and navigation equipment. New Lear dampers for the Grumman F9F-9 and those for lightplanes (Arcon) use mag amplifiers entirely. —PK

plant with a one-track mind...



Actually Twin Coach Aircraft Division is five plants—each devoted *exclusively* to aircraft production. We do no other work; we build no other products.

Here's why this is important. It means your airframe assemblies are built by experienced aircraft specialists . . . men who know no other standards than those of the aircraft industry.

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A-9122

TWIN COACH COMPANY
Aircraft Division **BUFFALO, N. Y.**

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WORLD'S KEENEST EYE?

PIN-POINT bombing from 10 miles up is a reality today. In B-47 Stratojets this is true in large part because of the Y-4 Periscope Bombsight, built by the Mechanical Division of General Mills. This remarkable instrument exceeds USAF accuracy requirements—does its job so well, in fact, that the major source of bombing error now lies in the bomb's action *after* it leaves the plane. This bombsight and the rest of the USAF bombing system also have brought aerial navigation to a new high in precision.

The Y-4, built under prime contract with the Air Force, is an example of the sound engineering and unexcelled craftsmanship found also in subcontract production and contract research at the Mechanical Division of General Mills.

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General Mills can help you with electronic and electro-mechanical research, design, development, production engineering and precision manufacturing in connection with . .

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THIS NEW BOOKLET tells the whole interesting story of the Mechanical Division. A copy will be gladly sent in response to your request on your company letterhead. Address Dept. A-1. Mechanical Division of General Mills, 1620 Central Avenue, Minneapolis 13, Minn.

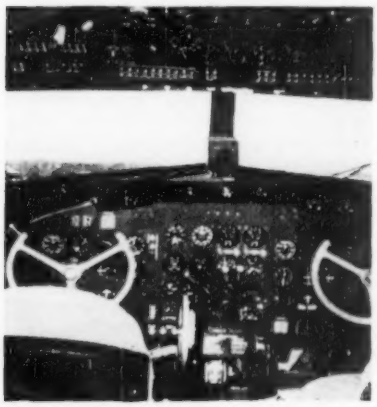
MECHANICAL DIVISION OF General Mills, Inc.

TAILOR-MADE DC-3—Flight Safety chose plane, supervised conversion for mining client.

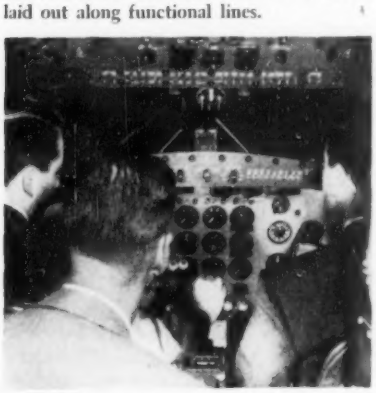
Firm Sets Up Business Air Fleets

Flight Safety, Inc., supervises entire operation, from choosing the aircraft to training the personnel.

Flight Safety, Inc., the organization that pioneered refresher and specialized training for business pilots (AVIATION WEEK Nov. 30, 1953, p. 21), has expanded the scope of its activities that are designed to help make the U. S. business aircraft fleet one of the safest and most efficient in the world.



INSTRUMENT PANEL of custom DC-3 is laid out along functional lines.



FLIGHT SAFETY instructor watches client's pilots check out in DC-3.

The original staff, all specialists in their field, has trebled and now numbers near 30. Facilities have been greatly expanded. With Flight Safety's enlarged scope, president A. L. Ueltschi believes his firm is equipped to handle the transportation requirements, "from A to Z," of any corporation operating or contemplating operation of aircraft.

▶ **Program for Business**—Now, the pilot training phase of Flight Safety's set-up is but one part—though a very important one—in an overall integrated business flying program. In this program, Ueltschi's firm does the following:

- **Analyzes the transportation** needs of a company that plans an aircraft operation.
- **Determines specifications** required to meet the user's needs.
- **Recommends type of aircraft** that is best suited to do the job.
- **Assists in acquisition** of the aircraft.
- **Prepares a detailed set** of specifications for the modification and conversion necessary to tailor the aircraft to the company's exact requirements.
- **Selects the conversion center,** on a bid basis, that can meet the specifications most efficiently and economically.
- **Maintains an engineer** at the conversion center to see that the specifications are complied with.
- **Test flies the aircraft** prior to acceptance for the client.
- **Organizes complete maintenance** engineering program for client's aviation division.
- **Organizes entire aviation** division for

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FLIGHT TEST INSTRUMENTATION

Openings exist at both Senior and Junior levels. Junior engineers will be accepted, without experience, for training in the above openings.

For additional information please send resume to:

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In the N. Y. area, pls. contact our representative, Mr. G. W. Benedict: 19 Rector St. Rm. 1609, N. Y. 6, N. Y.

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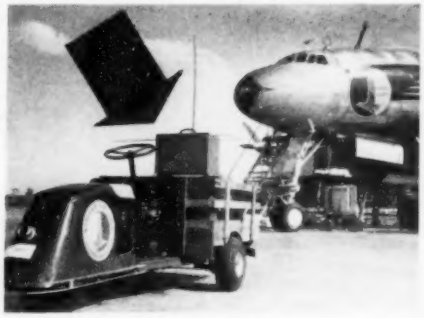

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Used by CAA approved repair stations, modification, service centers and military.

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Openings exist at both senior and junior levels. BS, MS or PhD in Mathematics, Physics or EE required. Junior engineers with this educational background, without experience, will be accepted for training in the above openings.

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Missile & Control Equipment Dept. B, Engineering Personnel

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company, stressing such specifics as accounting procedures, administration etc.

• **Recommends or selects pilots** and support personnel.

• **Provides refresher training** for pilots on a year-round, continuing basis.

• **Provides continuous maintenance** engineering consulting service.

Whether a company requires all, several, or only one of these services, Flight Safety is sure it is equipped to meet the needs. Most of its clients are multi-million-dollar organizations, such as Burlington Mills Corp., Gulf Oil Corp., International Harvester Co.

▶ **For Example**—A good illustration of Flight Safety's overall program in operation is its relationship with Pickands Mather & Co., a Cleveland iron firm with mining installations scattered throughout the country.

Like many other U. S. corporations, Pickands Mather felt the need of moving high-priced executives and engineers to and from its widely decentralized facilities in a minimum amount of time. Company officials realized that air transportation was the answer, but, being mining and not aviation experts, they had no idea how to go about setting up an aircraft operation.

Rather than face the possibility of getting off on the wrong foot and ending up with an unsuitable and uneconomic operation, they called in Flight Safety and turned the entire project over to them.

The net result was that six weeks later Pickands Mather was in possession of a custom-converted Douglas DC-3, tailored to their requirements, and they had completed their maiden flight. Two pilots and one mechanic had been hired, and the company's entire aircraft operation—complete with maintenance engineering service—was ready to roll. The entire operation was the result of careful analysis and planning on the part of Flight Safety personnel.

The plane that Pickands Mather bought was designed specifically to meet its traffic requirements. Its two 1,350-hp. engines and 26,200-lb. maximum gross weight were just what was required for the aircraft to cruise most efficiently and cope with the short-field requirements that are typical of the company's mining country operations.

Its instrumentation included the latest in navigation and radio aids necessary for the type routes which the company flies. Thanks to Flight Safety, Pickands Mather officials are now flying these routes day and night—confident that they have a safe efficient aircraft, properly maintained, with two top-notch pilots "up front."

This was accomplished at a total cost to the company of only a small fraction of the conversion cost of the airplane. Had Pickands Mather decided to set up the operation on their own they say

24 Houris...1 Hostage

One by one, the veiled women boarded the plane, bound for the old world after a glimpse of the new. The sheik was still in Washington, attending a diplomatic dinner. He would leave tomorrow — tonight, he was sending his harem home.

But not unguarded. A stout, turbaned officer shepherded them aboard, then motioned politely to the Airwork representative to precede him into the plane.

It was a special service flight for the Airwork man. He had just supervised the engine overhaul of the sheik's plane and was now making the flight to instruct the native mechanics who would care for it in the Middle East.

Once inside the plane, the guard loosened the automatic in his holster significantly. As the plane took off, he observed, "If these engines sputter, you will be the first to die." His tone was matter-of-fact, yet firm. The Airwork man swallowed hard, but said nothing. What *could* he say?

The rest of the story is anticlimax. The rebuilt engines functioned perfectly — the flight was without further incident, thanks to Airwork's high standards of overhaul, ensuring factory-new performance. Airwork production line techniques are equal to those of the original manufacturer. That is the only way to get unvarying quality.

Airwork will gladly handle your overhaul and supply problems. Ask about our personalized service, the Airwork exchange, and dealer programs.

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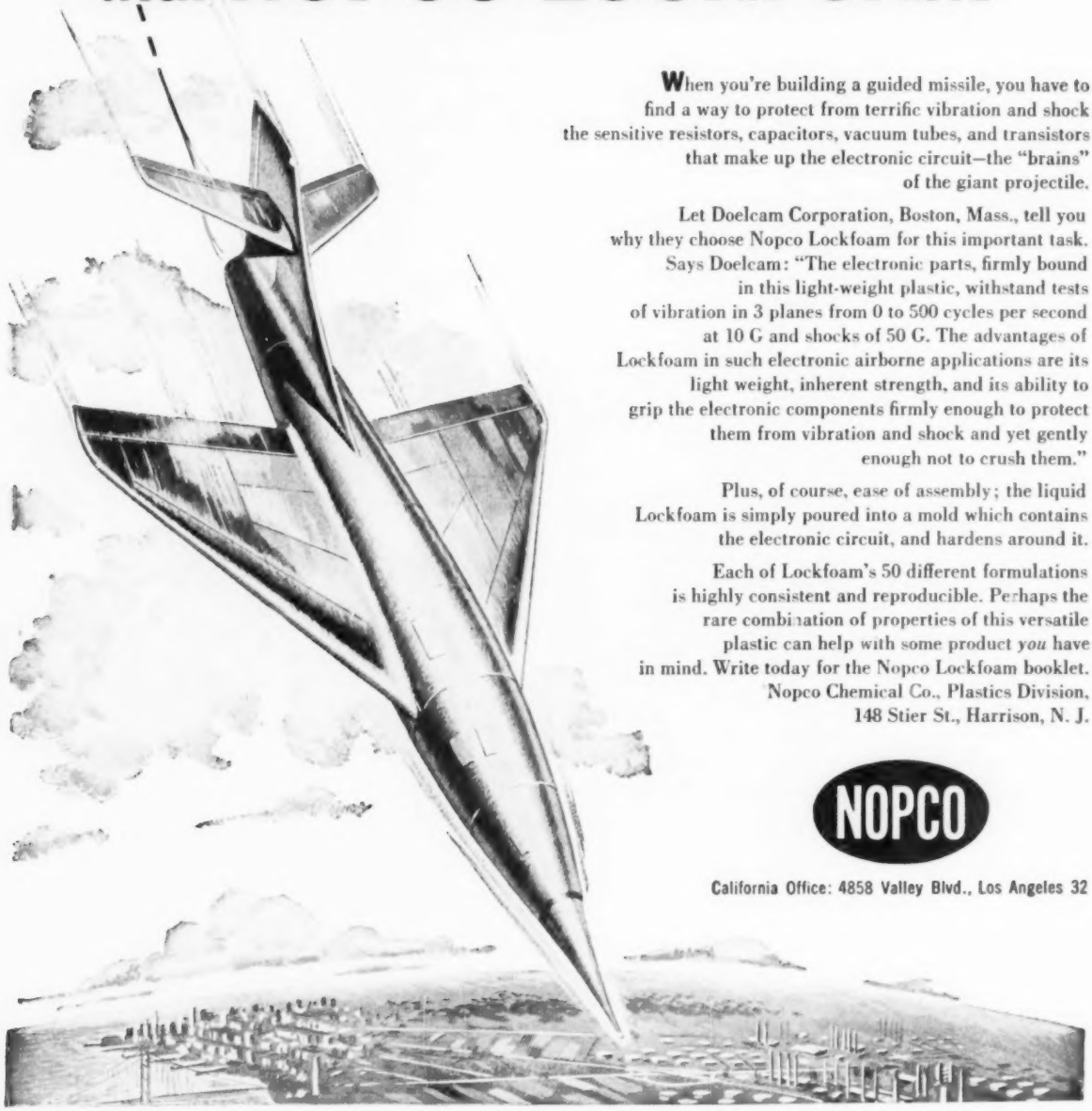
A ROUGH RIDE FOR THE ELECTRONIC UNIT!

So DOELCAM makes sure it rides safely with NOPCO® LOCKFOAM



When you're building a guided missile, you have to find a way to protect from terrific vibration and shock the sensitive resistors, capacitors, vacuum tubes, and transistors that make up the electronic circuit—the "brains" of the giant projectile.

Let Doelcam Corporation, Boston, Mass., tell you why they choose Nopco Lockfoam for this important task. Says Doelcam: "The electronic parts, firmly bound in this light-weight plastic, withstand tests of vibration in 3 planes from 0 to 500 cycles per second at 10 G and shocks of 50 G. The advantages of Lockfoam in such electronic airborne applications are its light weight, inherent strength, and its ability to grip the electronic components firmly enough to protect them from vibration and shock and yet gently enough not to crush them."

Plus, of course, ease of assembly; the liquid Lockfoam is simply poured into a mold which contains the electronic circuit, and hardens around it.

Each of Lockfoam's 50 different formulations is highly consistent and reproducible. Perhaps the rare combination of properties of this versatile plastic can help with some product *you* have in mind. Write today for the Nopco Lockfoam booklet. Nopco Chemical Co., Plastics Division, 148 Stier St., Harrison, N. J.

NOPCO

California Office: 4858 Valley Blvd., Los Angeles 32

they probably would have spent a great deal more for a lot less value received.

▶ **Careful Analysis**—Commenting on the Pickands Mather job, Flight Safety president Ueltschi says, "The entire project, like all our projects, was based on careful analysis—stressing safety, efficient aircraft utilization and economy—in that order.

"We began at the beginning," notes Ueltschi, "analyzing the exact traffic requirements—checking runway lengths of airports that would be most frequented, checking average year-round weather, airport altitudes, operational pattern and general passenger requirements."

Before making a choice, three aircraft types were analyzed for Pickands Mather by Flight Safety—the DC-3, B-23 and L-18.

Once the DC-3 was chosen as the most nearly suitable, its engines became the first consideration. Flight Safety engineers decided engines capable of producing 1,350 bhp. each at takeoff were needed, because of short-field requirements.

It was also pointed out that other advantages would accrue from using the higher horsepower engines, such as increased passenger loads without a sacrifice in speed or performance.

▶ **Safety First**—Throughout the operation, safety was the prime motivator in all of Flight Safety's actions. In writing the DC-3 specifications, for example, it listed the following under engines: "Complete fire prevention rework recommended by Flight Safety and in accordance with CAR 4B will be performed, including firewall shutoff provisions for fuel, oil and hydraulics."

This appeared under the section entitled propellers: "New type propeller de-icer feed shoes and boots will be installed to insure even distribution of prop anti-icer fluid. Also, alcohol flow meters will be installed."

And under general equipment came this notation: "All new high-shear magnafluxed wing bolts will be installed. All equipment specified must meet requirements of the CAR 4B section transport category."

Flight Safety specifications are detailed, as well as complete and comprehensive in their coverage. It is mandatory that all wiring be new, properly marked and that all wiring diagrams be supplied. The company notes that all too often such diagrams are missing on converted aircraft.

In addition, complete weight and balance and loading schedules are required, as well as complete radio diagrams. In certain of its specifications, Flight Safety calls for types of equipment by brand name.

Simultaneous with its basic considerations of safety and efficient aircraft utilization, the company stresses economy. Granting that efficient utilization means

the

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lowered costs in itself, Flight Safety also outlines a complete cost-cutting program for its clients–designed to keep operating expenses to a minimum without compromising safety or efficiency in any way.

► **Maintenance Engineering**–Worthy of consideration as a completely separate entity is Flight Safety's maintenance engineering program. Under this program, clients' maintenance requirements not only are thoroughly analyzed, but the maintenance engineering department will prepare complete maintenance manuals for individual company planes. This is not a general manual, but applies only to the aircraft in question. It covers such items as airframe, powerplant and accessories, and every system from autopilot to vacuum.

It is interesting to note that with DC-3 aircraft alone Flight Safety has written 10 different manuals, necessitated by the conversion differences in each plane.

Besides the manual, the maintenance engineering program set up by Flight Safety covers a recommended service pattern, service forms, a system of records and scheduling and service engineering.

The company also offers a program of continued maintenance engineering, whereby it will perform periodic inspections on the procedures, practices and standards being used on the operator's aircraft on a year-round basis at a cost of $50 per month per airplane. Also included in this program is instruction and indoctrination of the operator's personnel in the application to the maintenance program of all manuals, forms and related data as well as routine advice on re-equipment, development of new equipment and other things that come to light.

► **All in One**–In summary, Flight Safety now is a complete consulting, training and engineering service all rolled into one–designed to insure safer, more efficient and more economic operation of business aircraft.

Ueltschi points out that his firm serves as a centralized agency between corporations, manufacturers, pilots, conversion centers, aircraft distributors and anyone directly or remotely connected with business flying.

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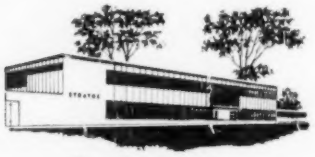

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AVIATION SAFETY

Official Report on Resort Airlines' C-46F Crash

CAB Pins Blame on Maintenance

THE ACCIDENT

At 1618,[1] Sept. 28, 1953, a Resort Airlines' C-46F, N 66543, operating as CAM No. 1081[2] crashed during landing at its destination, Standiford Airport, Louisville, Ky. There were 25 fatalities, including the crew of three, and 16 passengers received serious injuries. The aircraft was destroyed.

HISTORY OF THE FLIGHT

The flight was operating between North Philadelphia, Pa., and Louisville. It departed North Philadelphia Airport at 1303 on a Visual Flight Rules flight plan. The crew consisted of Capt. W. E. Moller, First Officer J. D. Pickel, and Stewardess D. J. Bush.

At departure the gross weight of the aircraft was 44,940 pounds (allowable 45,300 pounds), with 775 gallons of fuel aboard. Distribution of the load was within prescribed center of gravity limitations.

The trip between North Philadelphia and Louisville was normal and in good weather. In the vicinity of Standiford Airport, the pilot requested landing instructions and was cleared for landing on Runway 24 by the tower. The clearance was acknowledged by the pilot.

One of the three controllers on duty observed that the approach appeared normal until the flare-out when the aircraft "ballooned" slightly, power was applied, and about 500 feet farther on entered a steep climb. The aircraft then yawed to the left and climbed with a steadily increasing angle of attack. At this point he noticed that a portion of the left elevator was hanging down and immediately advised the aircraft but received no acknowledgment of his warning. The aircraft continued in a steep climbing left turn until it reached an altitude of about 300 feet, stalled, fell off to the left, and struck the ground on the nose and left wing.

The fuselage burst open upon impact. A number of the occupants were thrown free and emergency equipment immediately took survivors to nearby hospitals. Due to the severity of impact and the extent of damage, there was no organized evacuation by the occupants.

Fire broke out upon impact but was extinguished by fire fighting equipment at the airport.

INVESTIGATION

The other two controllers in the tower as well as several witnesses on the ground also saw the left elevator dangling. A number of these witnesses testified that the approach to landing was normal and the wheels had almost touched the runway when power was applied. All the witnesses were in agreement that the aircraft entered a steep climb which culminated in a stall. These ground witnesses stated that it was apparent that something was wrong with the left elevator, as it appeared to be hanging down. None of them saw anything fall from the aircraft.

Statements were obtained from surviving passengers who advised that prior to landing the seat belt sign came on and the stewardess went through the cabin to ascertain that all passengers had their seat belts fastened. They also stated that, to their knowledge, there was no abnormal operation or malfunction of the aircraft at any time during the flight until the flareout for landing at Standiford Airport.

Board investigators ascertained that the aircraft struck the ground approximately 50 degrees nose down with the left wing depressed approximately 30 degrees and coming to rest on a heading of about 140 degrees. The wreckage was localized to the left of Runway 24.

The forward section of the fuselage was crushed back to the wing leading edge. The left wing separated from the aircraft at the fuselage; the leading edge was severely damaged and the tip was torn off. Both wing flaps were found in the full-down position. The manner in which the main landing gear was torn off indicated that it was in down and locked position at impact.

The tail wheel was undamaged and was found in the down and locked position. Examination of the engines and propellers indicated no malfunction. The rear section of the fuselage buckled and was partially severed several feet forward of the main cabin door and several feet aft. All passenger seats were torn from the floor with the exception of three unoccupied seats in the rear of the cabin.

Although a thorough examination was made of the wreckage, investigation was primarily centered on the empennage group in view of the obvious structural failure of the left elevator. Examination of the flight control systems revealed no evidence of malfunction or failure prior to impact. The right stabilizer and elevator, as well as the vertical fin and rudder, were undamaged. The left horizontal stabilizer was buckled upward at two stations but was still attached to the fuselage. The inboard two-thirds of the left elevator was found still attached to the stabilizer by hinges Nos. 3 and 4 (numbering the hinges 1 through 4 from left outboard to left inboard). The outboard third of the left elevator was found in the immediate area.

Examination of the left elevator and its hinge fittings, details of which will follow, indicated that the No. 1 hinge bolt worked free from the hinge fitting and thus resulted in the outboard third of the elevator being

[1] All times herein are Central Standard and based on the 24-hour clock.

[2] CAM is the designation for Civil Air Movement flights, contract operations between the military services and civil air carriers.

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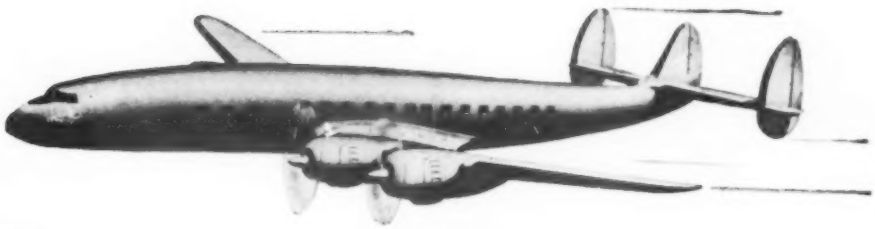

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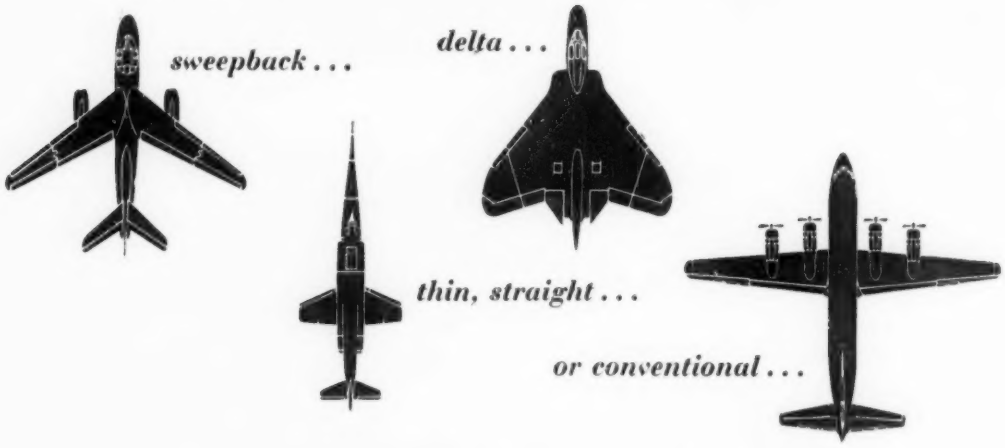

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unsupported. This section then bent downward during flight at No. 2 hinge station; therefore, the hanging portion of the elevator observed by witnesses was this outer third of the left elevator.

Both the elevator and stabilizer portions of the No. 1 elevator hinge bracket were attached to their respective surfaces but the No. 1 hinge bolt was missing. This bolt was found inside the crumpled leading edge of the left elevator tip, but the nut and cotter pin could not be found. Since the bolt had not failed, it was evident that the nut had backed off, allowing the bolt to work out.

Upon examining this steel bolt, an AN5-13 type, it was ascertained that it was not specified for this installation. The proper type bolt was NAS55-14. The bolt was severely worn about the shank and the portion most reduced in diameter was found to be that section which bore on the steel bushing installed in the inboard lug of the hinge fitting. Laboratory examination showed that wear on the bushing and the bolt shank matched, proving that this bolt was the last one installed in No. 1 hinge bracket. The wear and markings on the bolt shank and the hinge bushing indicated that the bolt had been loose in the bracket for a conservatively estimated 50-100 hours of flight.

The cotter pin hole of the bolt was clean and microscopic examination of the hole showed no noticeable distortion of the hole other than a small deformed area at one end. This distortion indicated that a cotter pin had been installed at some time. A flake of brass was found in the hole, but no brass deposit was found at either end of the hole. A laboratory report stated that its presence could have been an indication that a brass cotter pin had been used at some time. Since only one small particle of brass was found, it appears improbable that a brass cotter pin was installed during the pertinent period.

When the interposer and left stabilizer bracket for No. 3 elevator hinge were removed for laboratory examination, a brass cotter pin was found securing a nut on the vertical point in the interposer block. All other cotter pins were of steel. Slick Airways' personnel (who conduct maintenance on Resort aircraft) stated that they do not use brass cotter pins and none had been purchased by Slick for five years. Resort Airlines likewise has standing instructions that only steel cotter pins are to be used.

Laboratory examination of the steel bushings in No. 1 hinge bracket revealed, through hardness tests, that they did not meet the minimum required 125,000 psi. tensile strength by 40,000 psi. Being softer, they were more subject to battering and wear by the bolt. The holes of both bushings were beaten out of round.

There are four elevator hinge bracket assemblies on each elevator. Upon disassembly, it was found that the bolts installed in the right elevator were of the specified type, but all four on the left elevator were not.

The correct bolt to be used on all certificated C-46 aircraft was specified in CAA airworthiness Directive 47-51-2, which was in force at the time the elevators were last overhauled. The correct and incorrect bolts are so nearly alike that it is difficult to tell them apart by cursory inspection except for the designations on the head.

The incorrect bolt was shorter than the

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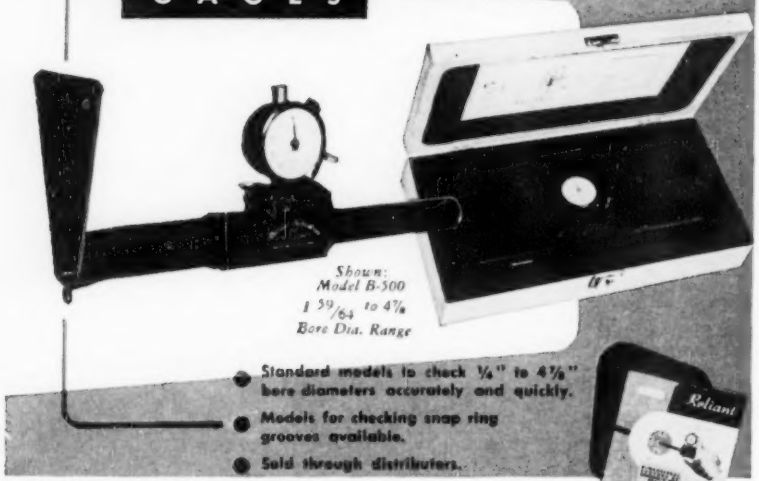

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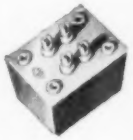

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correct bolt by one-eighth of an inch and its tolerance permitted a smaller diameter than the approved type bolt. Being shorter, the improper bolt installed in No. 1 hinge had less grip length and several threads rested on the bushings of the hinge bracket. The approved bolt, if used, would have had a tight fit in the assembly; the diameter of the nonapproved bolt could have resulted in greater clearance than desirable and thus induced greater vibration loads on the assembly.

Examination of the interposer ball bearings of the elevator hinge assemblies disclosed that only one of the four bearings on the left side was of the approved type. This is a self-aligning bearing, type KS5. The three incorrect type bearings were type K-5, a non-self aligning bearing. All four bearings for the right elevator were the approved type.

Overhaul and maintenance on Resort Airlines' C-46 aircraft was conducted under contract with the carrier by Slick Airways, Inc., in addition to other CAA-approved repair stations which handled minor maintenance on a contractual basis. The records of all work performed by Slick or these other agencies were forwarded to the headquarters of Resort for review to ascertain that the work had been performed in compliance with Resort's continuous maintenance and inspection procedures. Maintenance checks on Resort aircraft were to be performed at intervals of 70 hours for a No. 1, 125 hours for a No. 2, 250 hours for a No. 3, 500 hours for a No. 4, and 1,000 hours for a No. 5.

Resort's maintenance manual prescribed that the elevators were to be removed and overhauled at each 2,000-hour interval. At overhaul the interposer, bearings, and fittings for the elevators were to be removed and inspected. These items were to be re-

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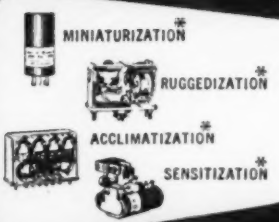

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placed as necessary and new bolts and cotter pins were to be installed at each elevator overhaul.

The maintenance manual further prescribed that empennage control surfaces were to be checked for security and attachment on all numbered checks. On all checks above a No. 1, the manual required inspection of all elevator fittings, attachments, and component parts.

With regard to pre-flight checks the maintenance manual prescribed that the fuselage and empennage were to be inspected for structural damage.

Between July 8 and 11, 1953, Slick Airways conducted a No. 3 inspection of the subject aircraft at San Antonio. This included removal and overhaul of the elevators owing to time requirements. Since this was the last overhaul of the elevators before the accident, the records of the overhaul were given careful study and personnel involved in the overhaul of the elevators were questioned regarding the work they performed. It was ascertained that the right and left elevators were both removed but there was only one work and parts replacement sheet.

Testimony indicated that the repairs and replacements listed on this sheet related only to the right elevator. Although a work sheet for the left elevator would normally have been completed to accompany the elevator overhaul sheet, none was found. None of the mechanics or inspectors had any recollection of having done any work or completed any inspections on the left elevator.

After the overhaul was completed, the aircraft underwent a preflight inspection before being test flown. This was accomplished by Slick Airways' mechanics and inspectors and included inspection of the elevator and fittings for proper attachment and safety.

In view of the fact that investigation disclosed a number of discrepancies in the left elevator, namely: nonapproved bearings, nonapproved bolts, and a brass cotter pin, these discrepancies were either the result of improper attention to assembly and inspection of the left elevator by Slick personnel, or the left elevator was worked on by some other agency between the time of this overhaul and the day of the accident. Therefore Resort Airlines maintenance records relating to this aircraft were carefully searched and a number of Resort, Slick, and Airline Services personnel were interviewed for any information on further work on the left elevator after July 11.

These reviews of the maintenance records and the interviews failed to reveal any indication of additional work on the left elevator. Further, the carrier's accounts applicable to N 66534 were carefully checked for bills from any source for work on the left elevator. This check also proved negative. Resort Airlines furnished the Board with an affidavit stating that no work was performed on the left elevator of the subject aircraft since the date of the last No. 3 inspection at San Antonio.

Slick Airways had also overhauled the elevators in June 1952. The records reflected the left elevator serial number for N 66534 as 2-65M. During inspection of the left elevator at the accident site, it was ascertained that the left elevator bore this same serial number. This therefore negated the remote possibility that there was replace-

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ment or removal of the left elevator after the No. 3 inspection at San Antonio in July 1953.

Following the No. 3 inspection, the aircraft underwent three No. 1's, two No. 2's, and one No. 5 inspections in the 412 hours it acquired to the time of the accident. The No. 2 and No. 5 inspections were conducted by Slick Airways and one of the No. 1's by Airline Services, Inc., of Oakland, Calif.

The Slick inspections were conducted at Miami, Fla., and Burbank, Calif.; the last numbered inspection was a No. 2 only 53 flight hours before the accident. No. 2 inspections include examination of the elevators, including the hinge bolt assemblies. Several work items on the elevators were performed during this last No. 2 check, but none of these items related to the hinge assemblies. A review of the records for these checks and testimony indicated that no discrepancies were found in inspections of the left elevator. If the No. 1 hinge bolt had begun to wear to an appreciable degree at the time of these inspections, it should have been found.

Between July 11 and the day of the accident the aircraft underwent almost daily pre-flight inspections. These pre-flight records were reviewed by Board investigators. Of the last six pre-flight inspections, two were signed by Capt. Moller, the latter prior to departure from North Philadelphia. None of the pre-flight inspections reviewed contained a report of discrepancy on the left elevator. Resort Airlines pre-flight inspection forms included an item that the elevators are to be inspected for structural damage, distortion, and security of attachment.

The company, the aircraft and the crew were currently certificated.

ANALYSIS

The ultimate failure of the left elevator was preceded by a series of events which permitted the No. 1 hinge bolt to work out of the assembly. This had to be preceded by the nut backing off the bolt.

It will be recalled that the cotter pin and nut were not recovered. Thus there are four possibilities with regard to the cotter pin: (1) it is possible that it was not installed at the time of the San Antonio overhaul, (2) not properly installed which would have permitted it to work out, (3) correctly installed but later removed by an unknown party, or (4) properly installed but worn away by the nut. This last possibility is considered the most probable starting point of this sequence.

Owing to the deep circumferential grooving of the hinge bolt, wear on the bore of the steel bushings in the elevator fitting lugs, and wear on the faces of the inboard lug, it is apparent that the hinge bolt was subjected to vibrational pounding over a considerable period of time. It is probable that during this period the nut was safetied by a cotter pin. The pounding would have included a very large number of small torque loadings of the nut which would have tended to wear away the cotter pin. It appears probable that a steel cotter pin was in place during this period, for a brass cotter pin would have coated the cotter pin hole with particles of brass.

The nature of the hinge bolt grooving and wear on the fitting indicated that the

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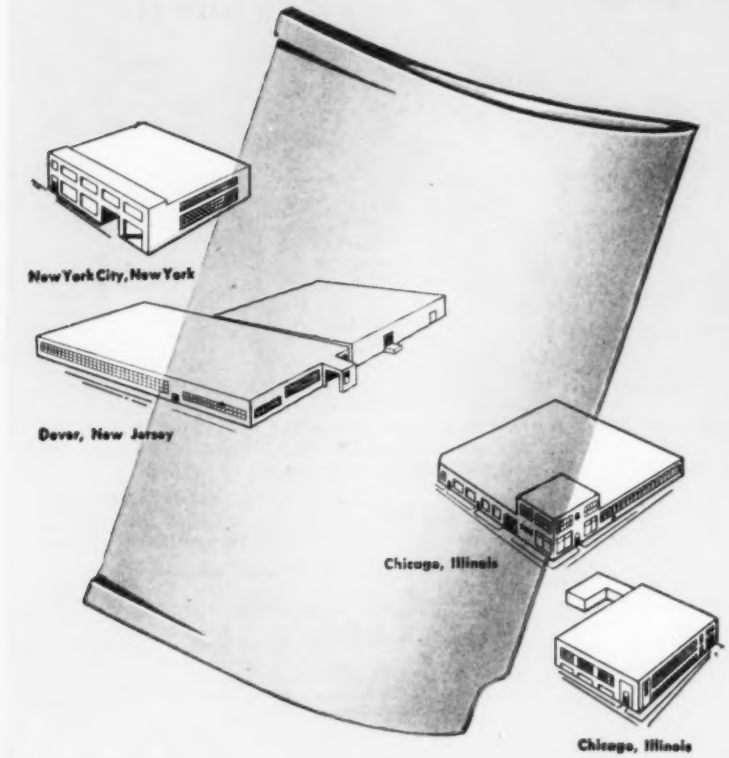

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bolt worked out very shortly after the nut started backing off, and further, that the nut backed off very shortly after it was no longer safetied. In light of this evidence it is highly improbable that the cotter pin was missing for a long period of time. Any numbered check or pre-flight inspection which failed to disclose the excessive wear of the hinge fitting or absence of the cotter pin, if it were missing at any of those times, must have been performed in a perfunctory manner.

Calculations entered in the record indicated that with the tip hinge bolt missing, the elevator could be expected to fail in smooth air at the second hinge from the tip due to loads resulting from elevator deflections within the normal operating range at all speeds from cruise to approach. It can therefore reasonably be deduced that the hinge bolt did not work from the hinge until the latter part of the flight from North Philadelphia to Louisville, and the flare-out for landing was the first moderately large elevator deflection after the bolt freed itself from the hinge fittings.

Many factors combined to produce the large amount of wear on the No. 1 hinge bolt, bushings, and lugs. Although the relative influence of these factors cannot be determined exactly, it appears that the use of the improper bolt contributed to accelerated wear in two ways. First, since the threads of the bolt extended into the inboard bushing, the bearing area was appreciably reduced and bearing stresses were increased for any given load. Secondly, the permissible smaller minimum diameter of the incorrect bolt can result in larger clearances than are desirable, with the result that vibration produces larger bearing loads.

Another factor in the excessive wear in the assembly was the use of steel bushings with a lower tensile strength and hardness than that specified. Still another appears to have been the use of the improper bearing; the K-5 type is a rigid bearing whereas the specified KS5 is a self-aligning type. The wear pattern showed misalignment of the fittings; bearing stresses would thus be higher than when a salf-aligning bearing was used. The worn condition of the parts indicated that there was insufficient torquing of the nut on the hinge bolt to clamp the bearing tightly enough between the steel bushings to prevent relative rotation between these parts; all rotation should take place within the bearing.

In addition to these, several other variables affected the service time which would have been required to produce the amount of wear. Among these are engine roughness, propeller disturbances, weather conditions, surface conditions of the airports from which the airplane was operated, and technique of the flight crews.

With such a large number of variables, it is impossible to determine with any degree of accuracy how long the wear progressed. However, a reasonable estimate appears to be a service period of 50-100 flight hours. In any event, it is obvious that excessive wear of the No. 1 hinge should have been detected in pre-flight inspections.

In view of the above discussion, a probable sequence of events can be established. It appears that accelerated wear in the tip

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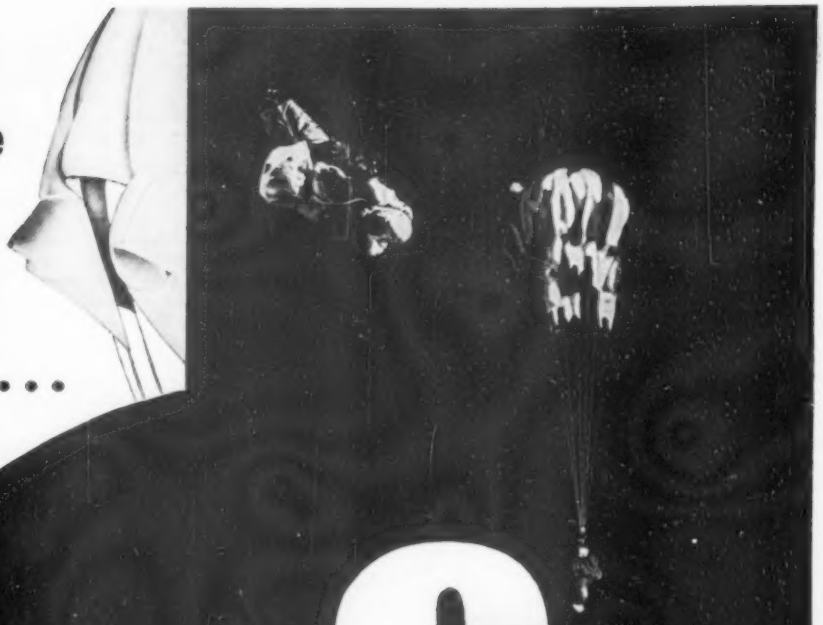

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hinge was the result of a combination of noncomformities and other factors. This probably caused the nut to work on the hinge bolt and wear away the cotter pin until it separated and worked out of the cotter pin hole. This probably occurred during the flight from North Philadelphia. With the nut no longer safetied, vibration quickly caused it to back off the hinge bolt and the bolt worked out of the hinge fitting. The bolt probably worked out as the aircraft was approaching Louisville.

When the crew applied up elevator in the flare-out for landing, the resultant down load on the left elevator was sufficient to cause downward failure in line with the second hinge from the tip. The balance area of the elevator ahead of the hinge line on the failed portion then interfered with the second hinge bracket and jammed, preventing the pilots from applying down elevator to counteract nose-up pitch of the aircraft. Application of power produced a steep climb which terminated in a stall and the crash.

The absence of records relating to overhaul of the left elevator by Slick Airways is indicative of poor maintenance practices. Further than this, it will be recalled that Board investigators were unable to ascertain through interviews with Slick personnel which mechanics worked on the left elevator. Careful review of all Resort Airlines' records relating to work performed on this aircraft following the No. 3 inspection failed to reveal that anyone had worked on the left elevator between that inspection and the time of the accident.

The Board therefore feels it may reasonably assume that the discrepancies which were found in the left elevator at the scene of the accident were overlooked by Slick Airways' personnel at the time of the July overhaul and subsequent numbered checks.

In view of the importance that the proper hinge bolts be installed, the CAA conducted a survey on all commercially operated C-46 aircraft immediately following the accident. It was found that a number of C-46s, including one owned by Resort Airlines, did not have the specified NAS-55 hinge bolts installed at all hinge positions. In all cases where improper bolts were installed at various hinge positions, it was found that the most wear had occurred at the outboard hinges. Although this special inspection covered all control surfaces and systems, unsatisfactory conditions were found only in the elevators and hinges.

FINDINGS

On the basis of all available evidence, the Board finds that:

1. The company, the aircraft, and the crew were currently certificated.
2. The flight between North Philadelphia and Standiford Airport, Louisville, was routine and in good weather.
3. The aircraft crashed on Standiford Airport when the left elevator failed at No. 2 hinge station.
4. The No. 1 hinge bolt worked free from the hinge fittings and thus resulted in the outboard third of the elevator being unsupported.
5. The four hinge bolts in the left elevator were a nonapproved type for this installation, as were three of the four interposer ball bearings; the bolts and bearings in the right elevator were approved types.
6. Major maintenance on Resort Airlines' aircraft was performed under contract by Slick Airways.
7. The left and right elevators were removed by Slick Airways' personnel during a No. 3 inspection of N 66534 at San Antonio, July 8-11, 1953.
8. Excessive wear and other deficiencies were not noted in any inspection by Slick Airways, Airline Services, or the carrier's personnel during the period between the No. 3 inspection and the day of the accident.

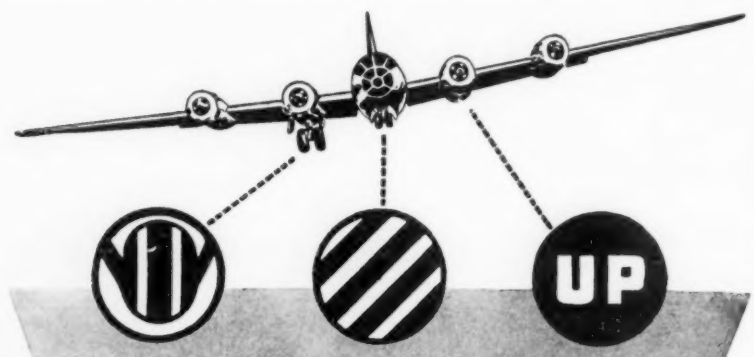
PROBABLE CAUSE

The Board determines that the probable cause of this accident was structural failure of the left elevator in flight, causing loss of control. This structural failure was brought about by the left outboard hinge bolt backing out of the assembly. The underlying cause was improper maintenance which resulted in the installation of hinge bolts and bearings not meeting specifications, and inadequate inspection which failed to detect this conditions.

By the Civil Aeronautics Board:

/s/ Chan Gurney
/s/ Harmar D. Denny
/s/ Josh Lee

Oswald Ryan and Joseph P. Adams, Members, did not participate in the adoption of this report.



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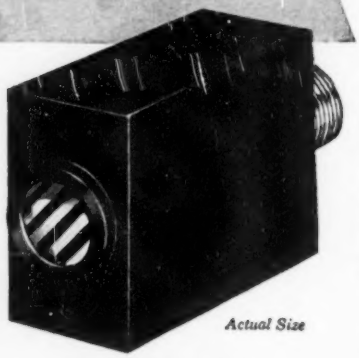

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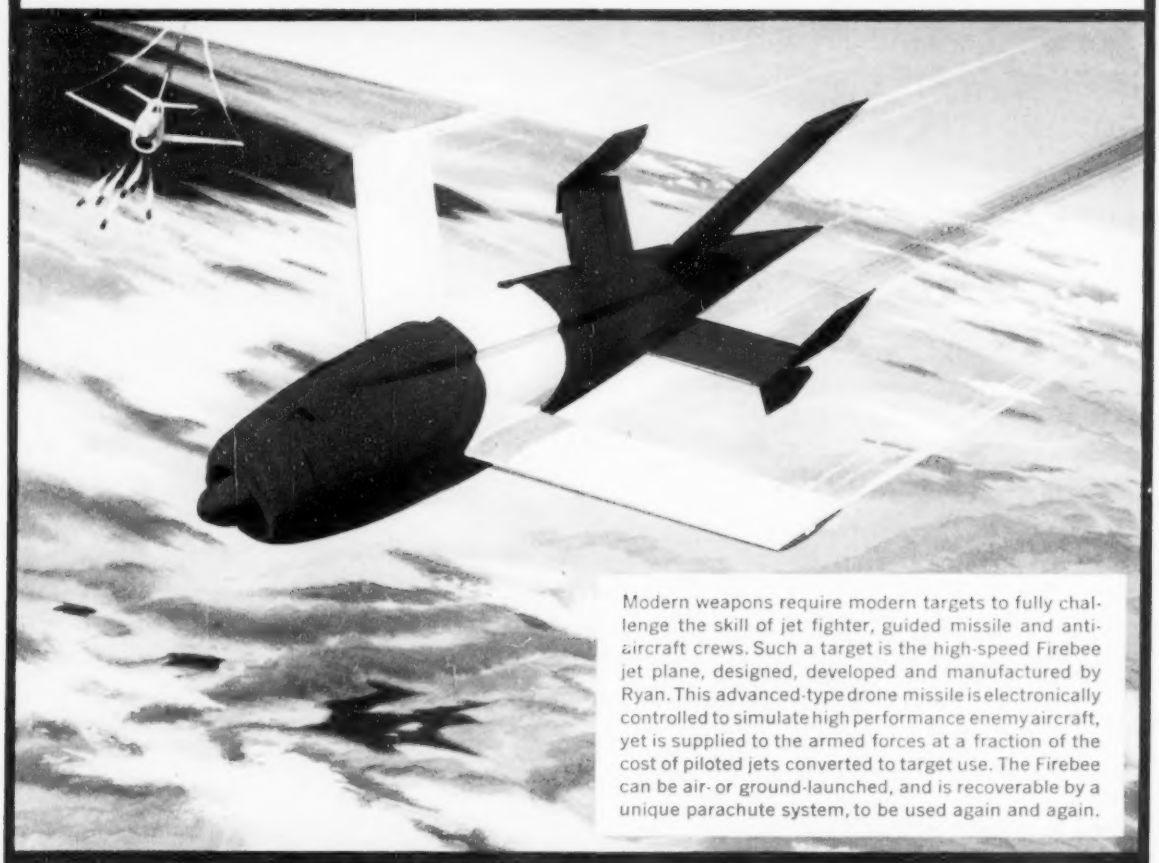

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BEA Viscount Verdict: 'Whale of a Plane'

- **Management and pilots are 'sold' on transport.**
- **AA Chief visits Vickers for first-hand look.**

By Frank Shea, Jr.

London—Is the much-publicized, highly-heralded Vickers' Viscount overrated, or are U. S. transport manufacturers really in for a run for their money?

If the enthusiasm demonstrated by operators and passengers of present turboprop Viscount fleets in Europe is any criterion for judgment, the latter most certainly is considered true.

British European Airways, for example, reports the Viscount is "a whale of an airplane" from almost every standpoint—performance, economy, safety and passenger comfort included. Other Viscount users say traffic is up and operating costs are down. Several are having record years, registering new peaks month by month.

► **Record Breaker**—BEA, first owner of the airplane and therefore the one with the most experience, in its first full year of Viscount operation is topping all previous traffic and revenue records (AVIATION WEEK Sept. 20, p. 92), logging an estimated 200,000 Viscount miles weekly on a continuous day and night schedule.

This adds up to plenty of volume, and volume is what BEA needs as a comparatively short-route operator. "With an average fare of just under $20, we must carry the greatest number of passengers in the shortest possible amount of time," Peter Masefield, the airline's chief executive, told AVIATION WEEK here.

"The Viscount definitely has been our salvation in this respect. In this airplane we can take 47 passengers from London to Rome, in 3½ hr., cruising at over 300 mph. Show me another airplane you can do that in and make money."

Another factor in BEA's traffic rise is its policy of maintaining the Viscounts on 90% tourist service. The low prices attract the masses, says Masefield, and passengers find they get a first-class ride in a first-class airplane.

"Except for the price, however, we at BEA don't really consider it tourist service," he adds. "We use a five-abreast, 47-seat configuration which is most comfortable in a Viscount interior

TAXIING VISCOUNT passes new terminal building at Zurich Airport after making run from London in a little over two hours. Flights consistently are cutting scheduled time.

MAINTENANCE HANGAR at London Airport, where all Viscount maintenance and overhaul is performed, is part of BEA overall engineering base rated among world's finest.

VISCOUNT INTERIOR reveals the five-abreast, 47-seat tourist configuration that BEA uses on majority of the aircraft's schedules. First-class service calls for 40 seats.

and, in addition, we serve a hot meal on most of the runs."

▶**Pilot Barometer**—Another strong indication that the Viscount is here to stay is the enthusiasm of BEA pilots. The reactions of the men who do the flying are considered about the best barometer for measuring the success of any aircraft. In the case of the Viscount, the reaction is pretty much unanimous.

In fact, BEA reports that once pilots have flown the Viscount, there is not one who willingly would go back to piston engine equipment—"either as pilot or passenger."

Chief Viscount pilot Arthur S. Johnson, RAF veteran and captain of the record-breaking Viscount New Zealand flight, calls this "an airplane of great sensitivity."

"It's extremely easy to handle once you've been flying it," he notes. "You touch something and the aircraft responds immediately. And it practically lands itself."

▶**Turboprop Training**—Despite this ease of handling, however, BEA cannot make Viscount pilots overnight of men who have been flying piston engine planes. There is a lot to learn, and the airline's instructors cover it all in a comprehensive four-month indoctrination course. This course is divided into five principal preflight phases, in which the pilots:

- Analyze and familiarize themselves with the airframe.
- Study every facet of the electronics system.
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They also ride in the cockpit of the aircraft as supernumerary crew members. When they actually begin flying the turboprop, they occupy the left-hand seat as first officer, flying with a fully trained pilot as captain. The remainder of the training is then "played by ear" according to the individual needs.

Average left-seat time is about 50 hr., Johnson reports, but during this time the pilot usually switches over to the captain's seat periodically.

▶**New Toy**—BEA presently maintains 58 Viscount crews. An additional six currently are in training, and about 28 more will go into training as new aircraft are delivered.

"One cannot help but marvel at the enthusiasm demonstrated by these crews," commented Johnson. Interviews with some of the crews bore him out. They demonstrated a spirit which reminds one of a child with a new toy, each one commenting on something he liked better about the aircraft.

This spirit is so strong it has reached the point of keen competition between each crew to see who can set the latest record on scheduled runs. Almost every week some crew brings the record time for a particular run down another notch, and pilots take great pride in marking these down on a large "scoreboard" in the chief pilot's office.

▶**Music to Vickers**—All this, of course, is music to the ears of Vickers-Armstrongs, Ltd., designer and manufacturer of the Viscount. Vickers thinks it's a "revolutionary" airplane, too, but they like to hear others say so.

"To date, Viscount orders have passed the 150 mark," notes Vickers' sales director R. C. Handasyde, "and we hope there are many more to come. We feel that we have the best-suited airplane presently available for medium and shorthaul routes."

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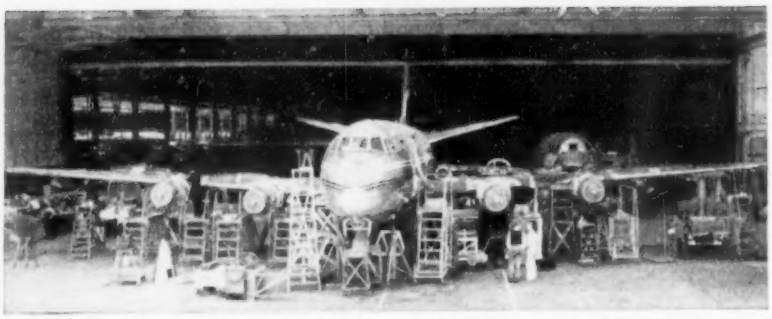
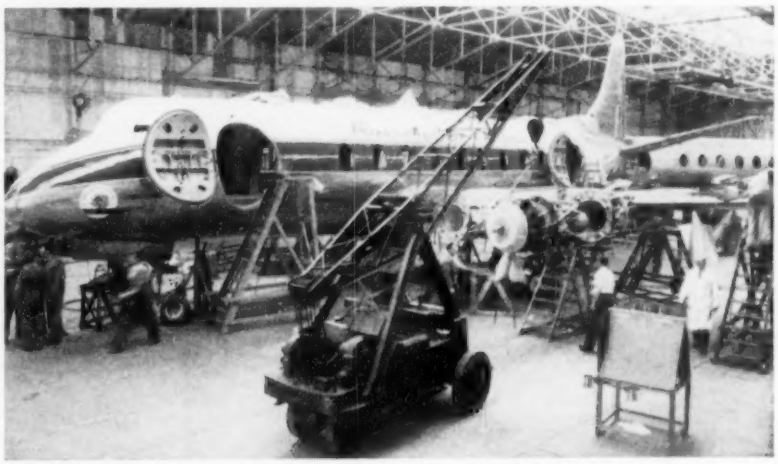


TRANS-CANADA'S first Viscount, slated for delivery this month, shown nearing completion at Vickers' Weybridge Works. Major portion of TCA fleet is being built at Hurn.



TRANS-AUSTRALIA'S first aircraft, also scheduled for delivery this month, receives engine installation at the Hurn plant. TAA has six Viscounts in all on order.

PRODUCTION LINE at Hurn plant looks small by U. S. manufacturers' standards, but Vickers keeps rolling out Viscounts on schedule. Aircraft above all are 700 series.

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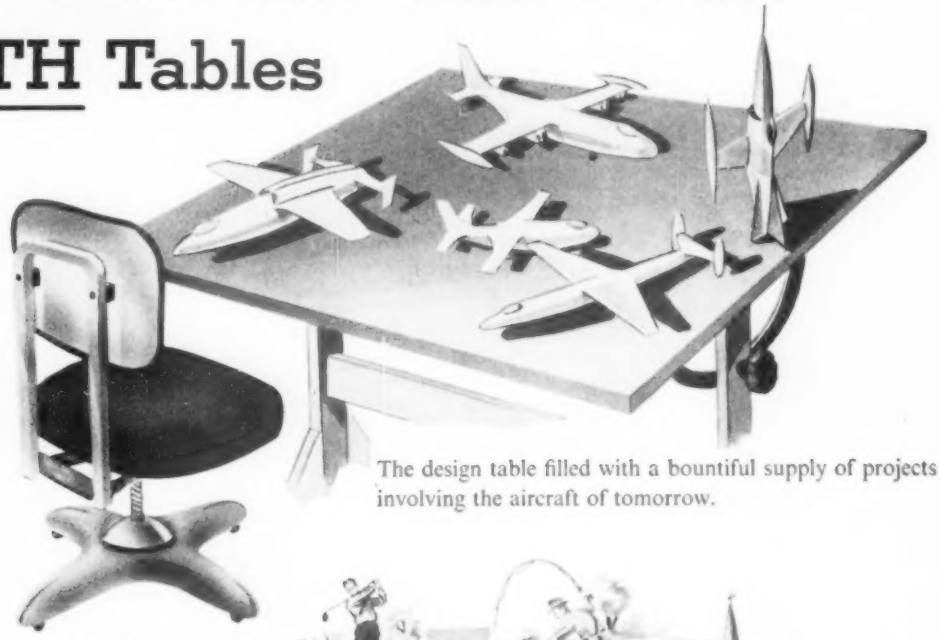
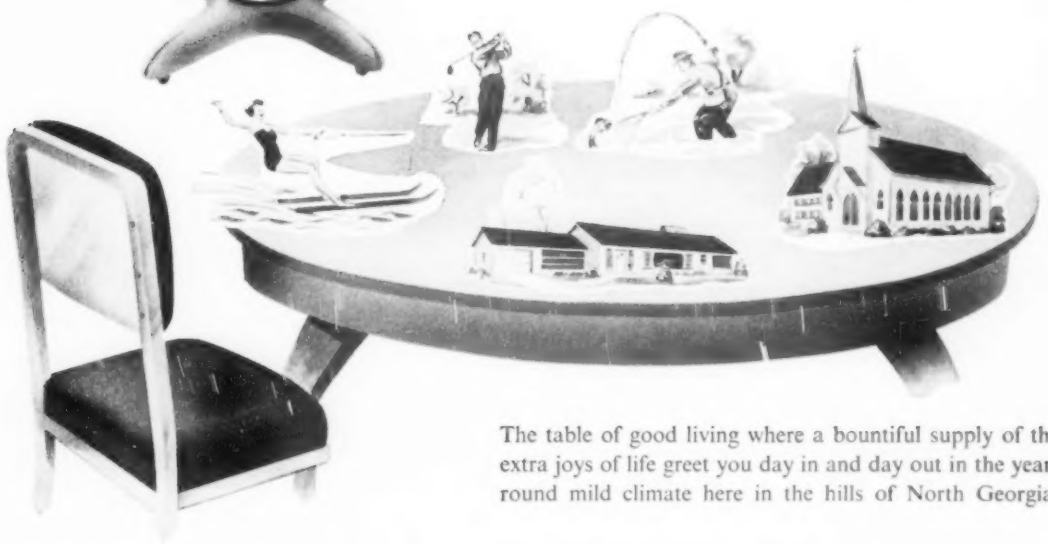


The design table filled with a bountiful supply of projects involving the aircraft of tomorrow.



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Reborn Lufthansa May Be Twins

BONN—It is either famine or feast for the Germans when it comes to civil aviation. For nine years they suffered without an airline of their own. But last week, as a result of these developments, they found themselves with two carriers:

• The Western Allies, as predicted by Aviation Week (Oct. 11, p. 99), gave the West German government their official sanction for revival of Lufthansa.

• The Soviet government announced that still another Lufthansa, from the Soviet Zone of Germany, would start scheduled operations in November, according to the Austrian Aviation News Service.

West Germany's Lufthansa will begin operations on or about Mar. 1 of next year. It is scheduled to receive its four Convair 340s next month and four Lockheed Super Constellations in the spring. European routes will be started first. When the Connies arrive, trans-Atlantic operations will begin between Hamburg and New York.

According to the Austrian report, the East-Zone Lufthansa will operate between Moscow, Berlin, Prague, Vienna, Budapest, Bucharest and Sovia, with a fleet of 16 two-engine and six four-engine aircraft of Soviet origin.

The report also said:

• Flight and ground personnel have been trained at Soviet airfields and in the Russian airline Aeroflot.

• The airline has been entered in the Soviet-zonal Trade Register with capitalization of 110 million East-Zone dm, subscribed half by the Soviet government and half by Soviet zonal organizations.

It also was claimed that the Russians have offered other Western airlines permission to use the air corridor to Berlin (now restricted to occupation powers) if they would land at Berlin's Schoenfeld terminal in the Soviet sector rather than at Tempelhof.

For this "privilege," East-Zone Lufthansa wants permission to begin service to Western European nations.

for the Viscount—with BEA, Capital Airlines and Trans-Canada Air Lines placing the biggest orders. Total BEA order is 38, while Capital and TCA will receive 40 and 22 respectively. The first TCA plane is being delivered this month.

▶ **Steady U. S. Stream**—Capital has been its only success thus far in efforts to penetrate the U. S. market, but a check of the guest book in Vickers' reception room reveals that a steady stream of U. S. airline officials have been dropping in to get a first-hand look at the aircraft.

C. R. Smith, American Airlines' president, was the latest visitor, accompanied by his financial vice president, William J. Hogan.

Vickers naturally would very much like to sell American. With all of AA's medium and shorthaul Convair routes, they feel the airline would be a natural for the Viscount. The sale would put both of Vickers feet, instead of one, in the U. S. market.

Also, if AA did order the Viscount, it would be considered a tremendous victory for Vickers in the tense rivalry that has developed between that company and Convair. Not only would Vickers be penetrating the U. S. market heavily, but they would be tapping Convair's biggest customer.

▶ **Improved Version**—In its quest for more orders, Vickers constantly is striving to improve the Viscount and increase its flexibility. Its latest effort, the Viscount 700D, will be out soon—with Central African Airways the first customer.

This aircraft retains the same basic fuselage and passenger capacity of the current 700 series, but offers higher performance at both ends of the range scale. It has more powerful engines and a lower specific fuel consumption for more economic operation.

The new Rolls-Royce R. Da.6 Dart engine develops a takeoff power of 1,550 shaft hp., compared with 1,400 shp. for the R. Da.3 Dart in the 700 series. This greater power allows increase in the maximum takeoff weight to 60,000-62,000 lb. and in the maximum landing weight to 54,000 lb.

▶ **Heavier Payload**—Vickers points out that on short routes at this higher landing weight, the aircraft will be able to carry its maximum payload of 12,800 lb. as well as the full fuel reserve needed on shorthaul routes.

Previously, there have been many routes on which payloads of medium-range aircraft have been restricted by fuel reserve requirements, the company notes.

The improved specific fuel consumption of the new Dart engine means that this greater payload on short ranges can be carried for the same total consumption as that used by the 700 series for its lower payload.

▶ **Increased Range**—At the other end of the scale, the increased engine power means the 700D can carry more fuel for longer-range operation. The fuel capacity has been raised to 1,950 imperial gallons, giving a maximum still-air range, with 8,200 lb. payload, of 1,000 nautical miles.

In addition, the aircraft is engineered to be equipped, if necessary, with two auxiliary slipper tanks. These will provide an additional 290 gal. of fuel and raise the maximum still-air range, with 7,450 lb. payload, to 2,400 statute miles.

These slipper tanks, not droppable though easily removed, are positioned outboard of the outer engines and protrude forward from the leading edge.

Other new features of the 700D series include:

• Four-tank fuel system, providing individual feed to each engine.

• "High activity" propellers, with no increase in diameter, to absorb the addition takeoff power of the engine.

• Lower gear ratio, giving a 10% reduction in cruising tip speed, resulting in lower propeller noise level.

Vickers' officials believe the 700-D series represents the start of a new line of development, with the R.Da.6 engine only at the beginning of its "stretch." "From this," says Handasyde, "is expected to follow still greater engine efficiency, lower specific fuel consumption, and longer overhaul life—all meaning lower costs to the operator.

▶ **Shorthaul Turboprop**—The Viscount 800, still another series under development, will be a shorthaul version of the Viscount with its best performance pegged at around the 450-nautical mile range. This aircraft will have a 3½ ft. longer fuselage, with the rear pressure bulkhead pulled back to afford 106 extra inches in the cabin.

It will have 700D wings, engines and undercarriage, with a performance of about 15 mph. faster than existing Viscounts but about 5 mph. slower than the 700Ds. BEA has ordered 12 for shorthaul routes, with eight more on option.

The carrier's 800 configuration will seat about 65 but can be increased to around 70—with five-abreast seating. Four abreast would seat about 52 or 53.

BEA has been assured by Vickers that the 800 series will be equally as economical to operate as the 700. First model will be delivered in June 1956.

BEA Orders S55s For London Shuttle

London—British European Airways has signed a contract for purchase of two Sikorsky S-55 helicopters from Westland Aircraft, Ltd. The airline will take delivery the end of this year.

BEA plans up to eight flights per day in each direction between the south bank of the Thames in the heart of London and London Airport with the two copters. The provisional one-way fare has been set at about $4.20.

Despite the higher cost of making the trip by helicopter, BEA expects the 17-min. flight time will attract many passengers when they compare it with the one-hour journey by airline bus.

CAA Tackles Mixed-Flow Airways

Official says compromises will be needed in air traffic controls to handle jet and piston-powered transports.

Compromises between operating requirements of turbojet transports and the air traffic control system will be necessary to handle the mixed flow of conventional and jet aircraft, Charles W. Carmody, chief of Civil Aeronautics Administration's Airways Operational Procedures Branch, believes.

▶ **'Collection of Troubles'**—"Our current studies are aimed at defining the specific problem areas, developing an immediate corrective program and examining the airways system, including communication, navigation and air traffic control facilities and procedures, to determine a basis for future planning," he says.

"We have become immediately aware that the 'jet problem' is not a problem, as such, but rather a collection of troubles common to conventional aircraft operations which are intensified by the greater speeds, higher altitudes and faster fuel consumption rates of jet aircraft."

Carmody outlined the "troubles" before a joint meeting of the Institute of the Aeronautical Sciences and Canadian Aeronautical Institute in Montreal, Canada, last week. Principal problems:

• **Traffic control** of jet transports as they near their destinations and prepare to land.

• **Altimeter errors** that are multiplied at higher altitudes and instrument lag in a high rate of climb or descent. CAA has established as an interim measure that aircraft above 30,000 ft. must be separated vertically by at least 2,000 ft. This reduces the available cruising above that altitude to one-half.

• **Cruise control practices** designed for maximum jet efficiency, wherein a constantly changing cruising altitude is desired.

• **Proper control of instrument approaches** of jet aircraft is hampered at radar-equipped stations due to the poor reflective surface of jets, a condition common to all aircraft without propellers.

• **Air-ground communication** needs further study. "The limited experience to date with flush-mounted antennae on turbojet aircraft," says Carmody, "particularly when used for frequencies in the UHF band, indicates a need for investigation of the seriousness of 'inverted cone-of-silence' and shielding effect caused by changes in the aircraft's attitude."

▶ **Streams of Traffic**—Outlining the problem of handling jet aircraft approaching terminals for landing, Carmody says: ". . . Streams (of landing traffic) may consist of as many as eight to 12 aircraft in various stages of leaving the holding patterns, being vectored toward the final approach, on final approach and occupying the runway during landing roll—all space at a minimum interval of three miles.

"The jet aircraft arriving at such a terminal, whose operator would insist upon maintaining cruising altitude until air traffic control was prepared to guarantee a relatively uninterrupted descent . . . interposes a considerable problem.

"It would require the halting of all other traffic at outer holding points as the jet leaves its cruising altitude; completion of all approaches in progress before the jet was cleared below 20,000 and then a hiatus in normal traffic flow until the jet was at a point where landing was assured, with no possibility of a missed approach. This type of requirement has actually been voiced as necessary to turbojet operation in civil air transportation."

Carmody estimates that this type of operation could cost the normal traffic flow as much as 17 to 30 min.—or as many as 15 or more conventional landings. "Such a situation at a terminal such as Chicago, New York or Washington would be intolerable," he adds.

▶ **Letdown Sequence**—The CAA official suggests that holding will have to be accomplished at higher altitudes.

"It is also felt," he says, "that some limited delay at an intermediate altitude during descent will be tolerated if, thereby, the progress of a sequence of aircraft will not be unduly interrupted. This will permit release of a turbojet aircraft from the cruising altitude, with an interim clearance to a lower level and with the expectation that further clearance will be available at or before reaching that level."

The incoming jet transport could start its letdown from cruising altitude to about 20,000 ft. while still approaching the terminal, Carmody says, and then hold briefly at or above that level.

"The penetration descent," he says, "would be made at an angle of 45 to 90 deg. from the outbound heading of the final approach path for about 10,000 ft. of descent, then a turn and completion of the descent to a holding point used to feed the final approach path.

"As the aircraft started its penetration turn, the approach control facility, using radar, would start to vector the aircraft as necessary to fit into an uninterrupted landing pattern of mixed conventional and turbojet aircraft."

▶ **Radar Control**—Carmody also points out that where two or more holding patterns are used, spaced to either side of the final approach path, the penetration descent could be made outbound far above the landing traffic with a right or left turn into either of the holding patterns.

At locations with longrange radar, jet transports could start descending at some distance before reaching the terminal. This would permit the jet to be merged into the flow of conventional aircraft and handled in a normal manner.

"It appears highly probable," he says, "that the higher fuel consumption rate during such a low-altitude operation would be partially overbalanced by eliminating the reqirement to maintain a high altitude over the airport before starting the lengthy penetration and approach procedure."

▶ **British Experience**—Carmody does not see priority handling of jet aircraft as an acceptable solution. The present "first come—first served" system of air traffic control will be retained.

". . . The turbojet will have to compete with other traffic on an equal footing except where its capabilities will enable it to move without detriment to conventional traffic flow," he says. "This is borne out by the experience and thinking of the British . . ."

Carmody used studies on jet transport operations prepared by R. D. Kelly and H. B. Kaster of United Air Lines and papers by Douglas Fraser, formerly of the British Embassy in Washington. CAA also has been engaged in a study of turbojet aircraft operations.

CAA Orders Safety Fixes on DC-6, S-55

Civil Aeronautics Administration has issued airworthiness directives on Douglas DC-6 emergency doors on the first 69 off the line, Sikorsky S-55 helicopters and Model LBM-1900 safety belts.

The directive on the DC-6 was issued following an investigation of an accident in which an emergency door on a United Air Lines DC-6 opened during a pressurized flight. The Office of Aviation Safety says affected DC-6s are to operate unpressurized until door hinges can be inspected for proper size and condition.

The S-55 directive says fore and aft transmission assemblies should be inspected daily to detect cracks. They may be inspected without removal by removing paint and other material from all welds and the areas around them. Cracked assemblies should be replaced immediately, according to the airworthiness directive.

Sikorsky is investigating the situation and is expected to come up with a

permanent repair that will eliminate the need for daily inspection.

Tests conducted by the Bureau of Standards revealed that Model LBM-1900 safety belts manufactured before Apr. 1, 1954, are understrength by technical standards.

This model belt no longer can be used in civil aircraft.

Post Office to Expand 3-Cent Mail Flights

Post Office Department has moved to expand its three-cent-mail-by-air experiment to the West Coast. In a petition to Civil Aeronautics Board, Post Office has asked approval for service to 19 West Coast cities.

Early CAB approval is expected, since Post Office Department wants to get the project under way by Nov. 1 in order to be operating during the Christmas season. The initial period of service would last until Sept. 30, 1955.

The rate asked in the petition is 18.98 cents a ton-mile, which compares with the 18-20 cent rates in use for similar trunkline service between Chicago, New York, Washington and Florida, and 30 cents for feederlines.

Post Office Department figures the service would be speeded up by as much as 48 hr. between the Washington, Oregon and California points specified.

ATA Lists Scheduled Airline Fatality Rates

Scheduled domestic and international airlines flew 19,682,770,000 passenger-miles from October 1953 to September 1954 with four accidents involving a total of 50 fatalities, Air Transport Assn. reports.

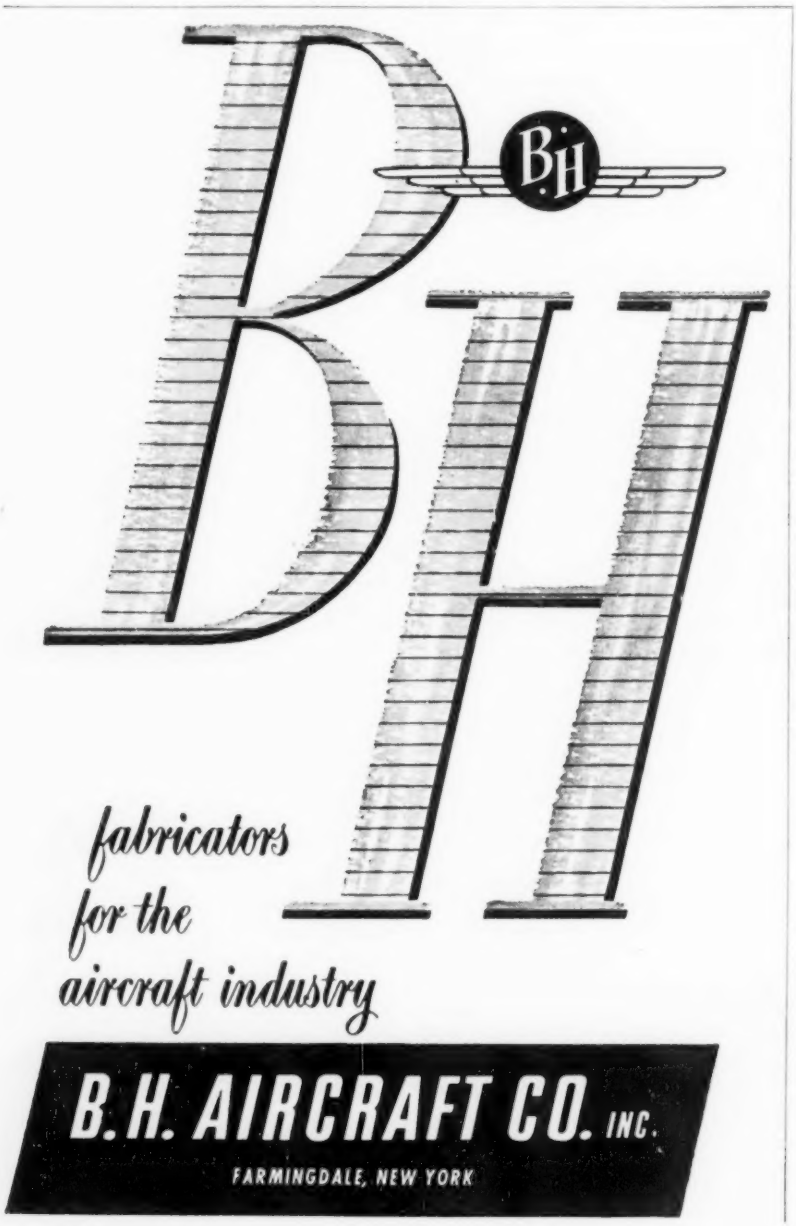
Fatality rate, per 100 million passenger-miles, was 0.21. Domestic rate was 0.25, international 0.06.

At the end of September, territorial service airlines had been without a fatal accident for 295 months, local service carriers for 42 months, international air carriers 11 months and domestic trunklines one month.

The domestic crashes included:

- **American Airlines** Convair 240 Sept. 16, 1953, at Albany, N. Y., killing 25 passengers and three crew members.
- **Western Air Lines** Convair 240 Feb. 26, 1954, near New Castle, Wyo., killing six passengers and three crew members.
- **Braniff Airways** DC-3 Aug. 22, 1954, near Mason City, Iowa, killing nine passengers and two crew members.

The only international crash occurred Oct. 19, 1953, when an Eastern Air Lines Constellation 749 crashed on takeoff at New York's Idlewild International Airport, killing two passengers.



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CAB ORDERS

(Sept. 16-22)

ORDERED:

United Air Lines' application for authority to suspend service temporarily at Dalles, Ore., be consolidated with UAL's application for abandonment of such service.

Mohawk Airlines' authority for flights to Pittsfield, Mass., be extended from Sept. 26, 1954, to Oct. 31, 1954.

Trans World Airlines be authorized to suspend international service from the coterminals Chicago and Detroit from Sept. 27, 1954, to June 1, 1955.

Western Air Lines authorization to suspend service at Jackson, Wyo., from Sept. 26, 1954, to June 15, 1955.

Interchange agreements involving Delta-C&S Air Lines, Trans World Airlines, Capital Airlines, National Airlines, American Airlines and Continental Air Lines approved as amended.

DENIED:

City and county of San Francisco's petition for leave to intervene in the additional southwest-northeast service case.

GRANTED:

Flying Tiger Line's application for exemption to fly two charter flights, one from Athens, Greece, to New York, another from Munich, Germany, to New York. Permission for a third flight, Munich to New York, is denied.

DISMISSED:

Great Lakes Storage & Moving Co.'s application for a permanent certificate of public convenience and necessity. The company does not desire to proceed with the matter at this time.

Transocean Air Lines' application for an exemption for a charter flight from Washington and Philadelphia to Goose Bay, Labrador, at the company's request.

SHORTLINES

▶ **American Airlines** marks its 10th year in the airfreight business this month; the first scheduled flight, a DC-3, took off from New York's LaGuardia Airport Oct. 15, 1944. Traffic has increased from less than 2 million ton-miles in 1945 to 54 million ton-miles in 1953.

▶ **Switzerland** and South Africa have agreed to establish commercial air service between the two countries. Service will be run by Swiss and South African companies.

▶ **Trans-Texas Airways** had a record traffic month in August, despite damage caused interline traffic by the American Airlines strike. Load factor topped 40% for the first time, with 12,560 passengers being carried 3,352,390 passenger-miles.

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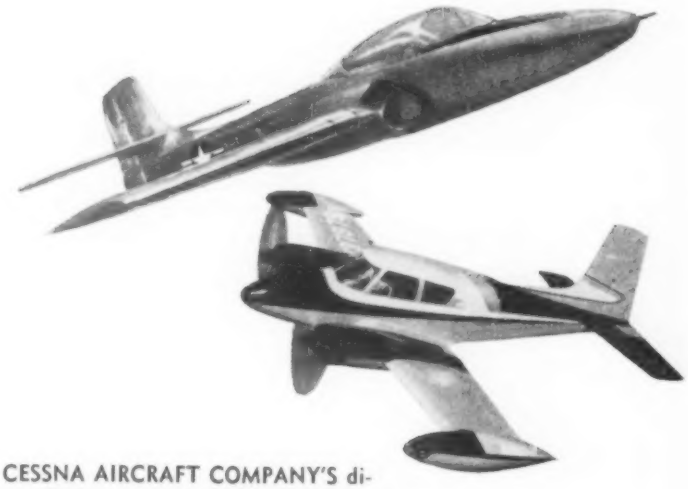

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PRINCIPAL AERODYNAMICIST—Preliminary Design B.S., M.S. or Ph.D. in Aeronautical Engineering, 6-10 years of aerodynamic design experience during which both theoretical and practical aspects of subsonic and supersonic aerodynamics have been applied to preliminary design and analysis of high speed guided missiles and/or aircraft. Applicant must be thoroughly familiar with performance and control parameters. Will work closer with electronic, servo, and systems engineers to produce most efficient and reliable weapons systems.

TECHNICAL WRITER Engineering degree or B.A. with engineering background. 5 years combined experience in preparation of aircraft and/or guided missile technical reports. Interpret technical information resulting from analysis and study from all sections of Guided Missiles Engineering and editing same, integrating into final technical reports.

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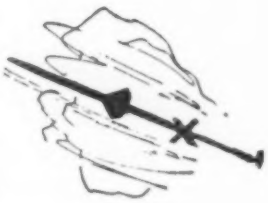

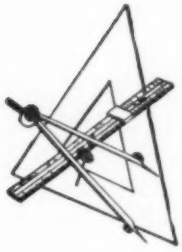

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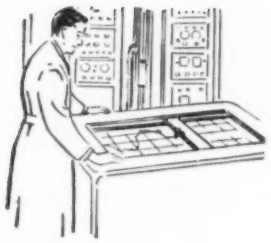

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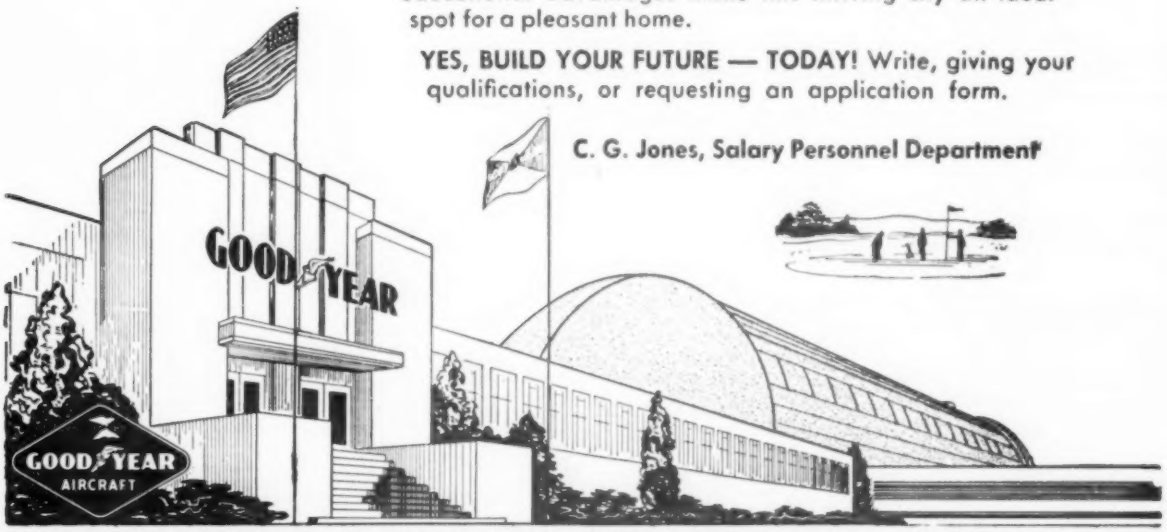

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ENGINEER — EXCELLENT opportunity for engineer with at least 1 year's experience in planning, supervising, and evaluating component and jet engine flight test programs. Our company is internationally known, a pioneer in the jet engine field, and is noted for its excellent working environment, vast facilities, and opportunities for individual and professional growth. Location-Midwest. Please submit complete resume to: P-4224, Aviation Week.

POSITIONS WANTED

CURRENT AIRLINE Captain—available Nov. 1st. ATR, 6500 Hrs., A&E license. Executive experience. Married, sober, reliable, references. Age 33. PW-4089, Aviation Week, San Francisco, Calif.

ROTARY-WING Project Engineer 14 yr. experience, all types rotorcraft. Desires position with good potential. Write PW-4264, Aviation Week.

COMPANY PILOT, Commercial Pilot, flight instructor, S.E.L., M.E.L., M.E.S., Instrument. A & E Mechanic. 14 years in aviation industry. Thoroughly experienced in maintenance, corporation flying and aviation sales. Resume on request. PW-4238, Aviation Week.

FOR SALE

Largest stock in the U. S., of new, used and overhauled engines, propellers, accessories and airframe parts. Free lists by makes. Vestco., Dept. F, Box 5306 T.A., Denver, Colo.

For Sale, 6 allison engines, model EV-1710-117. Total time between 200 and 400 hours since new. Need minor overhaul. Less auxiliary stage supercharger. Engines boxed and ready for shipment. Bids will be received until 12:00 noon of November 15, 1954. Full information available from Dean, School of Engineering, University of Wichita, Witchia, Kansas.

Navion, Ryley twin 150 HP engines 110 hrs since new. Airframe 400 hrs since new 80 gal. fuel. Lear and RCA VHF transmitters. Lear Ommin scope. RCA Beacon receiver, full panel flight instruments. Corporation aircraft always hangared and excellently maintained. $30,000. Burrus Mills, Inc. Box 13225 Dallas 20, Texas.

Wanted Twin engine Beechcraft any model condition not important as we will overhaul in our shops. Please quote your lowest price. Southern California Aircraft Corporation, Box 433, Ontario, California.

Bids: November 30, 1954

Notice of Public Sale of Property State College, Mississippi

PUBLIC NOTICE IS HEREBY GIVEN that Mississippi State College, State College, Mississippi, will sell at public bid opening, to the highest bidder, in accordance with conditions in the detailed bid specifications, at 2:00 P. M. on November 30, at Mississippi State College, two Army Surplus Stinson Aircraft, Model L 13 A.

Property is located at the Delta Branch Experiment Station, Stoneville, Mississippi. Security in form of certified check or bidders bond equal to ten per cent of total bid required.

Property offered on "as-is" and "where-is" basis. Mississippi State College reserves the right to reject any and all bids or to withdraw the property from sale.

Detailed conditions of sale may be obtained from the Purchasing Agent, P. O. Box 307, State College, Mississippi.

ATTENTION ENGINEERS

Aeronca Manufacturing Corporation

a leading sub-contractor for the aircraft industry has immediate openings in its new research and development group for engineers qualified in

Applied Aerodynamics
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Build your career with an expanding progressive company where advancement is assured for engineers with ability and initiative.

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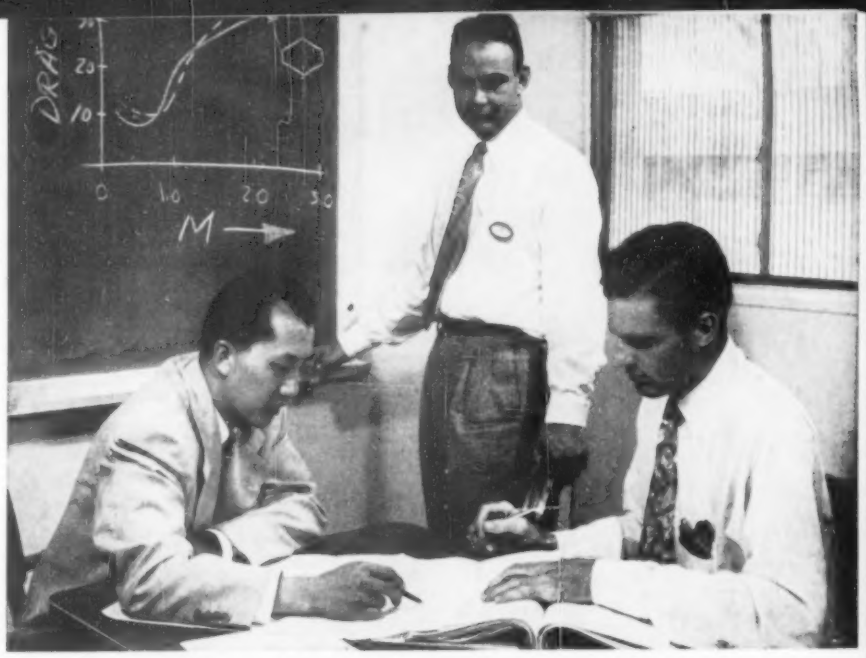
An Opportunity

WIND TUNNEL RESEARCH

An excellent opportunity exists for recent graduates with an Aeronautical Engineering option or degree to enter the field of large scale, high speed wind tunnel operation. After a short period of informal training, the graduate would receive the assignment of assistant project leader. In this post he would assist in the planning of test programs and instrumentation requirements for model tests and air flow calibrations. Actual experience will also be gained in the supervision of data reduction, analysis, and report preparation.

Additional information concerning the position described above and others is available upon request.

CORNELL AERONAUTICAL LABORATORY, INC.
BUFFALO 21, NEW YORK



Jim Hong, Aerodynamics Division head, discusses results of high speed wind tunnel research on drag of straight and delta wing plan forms with Richard Heppe, Aerodynamics Department head (standing), and Aerodynamicist Ronald Richmond (seated right).

Lockheed Expands Aerodynamics Staff

With five prototypes already in or near flight test, Lockheed's Aerodynamics Division is expanding its staff to handle greatly increased research and development on future aircraft in commercial and military fields.

The five prototypes, which show the breadth and versatility of Lockheed engineering, are: The XF-104 supersonic air superiority fighter; XFV-1 vertical rising fighter; C-130 U.S.A.F. turbo-prop cargo transport; R7V-2 U.S.N. turbo-prop Super Constellation transport; and an advanced jet trainer of the T-33 type.

New projects now in motion are even more diversified and offer career-minded Aerodynamics Engineers and Aerodynamicists unusual opportunity to: create supersonic inlet designs for flight at extremely high altitude; match human pilots with rapid oscillations of supersonic aircraft at low altitude; develop boundary layer control systems for safe take-off and landing of fighters and transports; remove aileron reversal and tail flutter problems incurred in high speed flight through analysis and design; participate in determining configurations of turbo-prop and jet transports and advanced fighters, interceptors and bombers.

To Aerodynamics men interested in those problems Lockheed offers:

increased salary rates now in effect; generous travel and moving allowances; an opportunity to enjoy Southern California life; and an extremely wide range of employee benefits which add approximately 14% to each engineer's salary in the form of insurance, retirement pension, sick leave with pay, etc.

You are invited to write E. W. Des Lauriers for an application blank and brochure describing life and work at Lockheed.

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FS-4241, Aviation Week
520 N. Michigan Ave., Chicago 11, Ill.

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EXPLOSIVES

Pieces	
8,948	56S-4A
28,477	56S-100-V4D
16,540	56S-100-V6A
2,100	56S-134-A4
200	56S-134-A8
14,898	56S-134-100-8
9,380	56S-134-100-10
2,600	56S-134-100-12
1,140	56S-173-100-8
4,250	56S-134-100-14
250	56S-134-100-20
8,110	56S-173-A10
400	56S-173-A14
2,000	56S-173-A16
46,050	56S-173-100-10
1,000	56S-173-100-14
899	56S-134-100-16
450	56S-173-100-20
950	56S-173-100-22
511	56S-173-100-24
500	56S-204-A10
2,760	56S-204-A18
2,512	56S-204-A26
2,000	56S-204-A28
164,000	56S-204-A12
78,000	DR127-A-4
106,000	-A6
932,600	-A8
100,000	-A10
117,100	-A12
29,000	-A14
16,000	-A16
7,990	-A20
43,700	DR134-A20
5,000	-100-10
5,000	-100-12
1,000	-100-24
221,400	-115-6
21,800	-115-8
181,500	-115-10
3,850	-115-12
176,940	-115-14
1,270	-115-20
817,000	DR173-A6
646,010	-A8
699,822	-A10
491,050	-A12
8,960	-A14
26,500	-A15
11,800	-A16
1,000	DR173-A18
20,900	-A20
1,940	-A20
470	-A22
4,510	-A24
1,455	-A48
41,650	-100-12
285,500	-100-14
34,750	-100-18
4,790	-100-22
1,690	-100-26
3,000	-100-28
300	-100-32
960	-100-48
1,594	DR204-A4
11,400	-A10
5,500	-A12
20,000	-A14
4,460	-A16
500	-A18
11,175	-A18
5,000	-A24
1,425	-100-20
1,910	-100-22
1,500	-100-24
14,500	-A18
2,700	-A22
1,000	-A24
92,990	-A26
55,800	-A28
44,600	-A30
500	-100-14
2,510	-100-26
2,830	-100-28

CHERRY

Pieces	
12,182	CR112-4-2
6,124	-4-4
60,000	LS113-4-2
2,500	CR113-4-6
2,000	-6-6
100	CR117-3-4
1,050	-4-10
1,500	-4-14
3,470	-5-8
274	-5-12
765	-5-14
1,573	-6-4
2,094	-6-12
539	-6-14
500	-6-18
2,982	CR143-6-4
500	CR146-6-11
11,500	-6-12
420	CR157-4-8
8,989	-4-10

RIVETS
CHERRY

Pieces	
5,000	-4-12
5,000	CR157-4-12
4,045	-5-4
1,630	-5-6
5,415	-5-8
1,360	-5-12
23,525	-6-6
200	-6-8
14,190	-6-12
5,186	CR178-C4-12
117,394	-6-6
199,394	CR179-5-2
98,444	-5-6
139,094	-5-8
400	-5-14
680	-C6-22

HI SHEAR RIVET PINS

Pieces	
278	NAS177-6-9
318	-6-12
1,410	-6-13
281	-6-14
99	-6-18
188	-6-20
114	-6-21
95	-6-22
100	-6-23
100	-6-24
850	-6-25
100	-6-31
1,100	-8-6
11,906	-8-13
3,285	-8-14
1,200	-8-15
19,700	-8-17
802	-8-18
100	-8-19
100	-8-20
104	-8-21
102	-8-22
93	-8-23
150	-8-24
64	-8-25
330	-8-31
432	-10-6
331	-10-8
1,230	-10-10
1,057	-10-11
20	-10-12
465	-10-14
260	-10-16
716	-10-17
218	-10-18
590	-10-19
720	-10-20
500	-10-21
500	NAS177-10-22
650	-10-23
800	-10-24
600	-10-25
1,190	-12-5
500	-12-6
500	-12-7
2,630	-12-8
864	-12-9
2,327	-12-10
674	-12-11
469	-12-12
810	-12-14
2,111	-12-15
900	-12-16
535	-12-17
530	-12-18
650	-12-19
470	-12-20
190	-12-21
37	-12-22
415	-12-23
832	-12-24
70	-12-25
90	NAS179-4-2
320	-6-4
7,380	-6-6
790	-6-18
93	-6-19
100	-6-20
100	-6-21
100	-6-22
100	-6-23
107	-6-24
310	-6-25
100	-8-2
21,360	-8-3
88	-8-13
1,700	-8-14
50	-8-15
255	-8-19
90	-8-20
134	-8-22
114	-8-23
100	-8-24
400	-10-3
188	-10-12
15	-12-15
912	-10-17

RIVETS
HI SHEAR RIVET PINS

Pieces	
891	-10-18
437	-10-19
913	-10-20
264	-10-22
88	-10-23
295	NAS178-10-24
470	-10-25
200	-10-28
710	-12-4
88	-12-5
112	-12-6
256	-12-7
12	-12-17
11	-12-18
73	-12-19
446	-12-22
249	-12-23
503	-12-26
159	-12-27
425	-12-28
559	-12-29
66	-12-30
190	-12-31
100	-12-32
200	-12-33
22	-12-36
200	-12-34

CAMLOC PARTS

GROMMETS

Pieces	
52,786	4002-A
4,460	-B
20,125	-C
112,000	-E
55	-G
860	-N
8,500	-SW

FASTENERS

10,000	4002-1
261,165	-2
284	-3
11,000	-4
144	-4W
22,000	-6
300	-6W
16,785	-7
10,000	-8
494	-24
4,068	-25

RECEPTACLES

3,500	244-16
3,526	-16D
13,000	-22
20,657	144-22D
3,031	-22

STUDS

630	2600-W6
20,657	144-22D
3,031	-22

LATCH FASTENERS

100	KM610-51

DZUS FASTENERS

Pieces	
9,889	A3-20
5,789	AW3-20
24,172	AJ3-25
1,628	AW3-25
10,450	AT3-25
190	AJW3-30
29	AJW3-35
63	ASW4-30
2,313	F4-30
922	AJ4-30
3,291	A4-35
301	AJW4-35
38	FW4-35
8,562	AW4-40
16,989	F4-45
2,340	AJW4-50
2,095	F4-50
990	AW4-50
5,200	S4-125
43,681	GF4-150
3,005	S4-250
90	S4-275
1,880	SC5-2
2,928	SB5-2
7,179	AST-35
1,008	A5-35
81,507	FA5-35
2,250	A5-40
201	A5-50
5,037	AJ5-50
1,720	F5-50
727	FA5-50
370	FA5-55
136	A5-60
664	AO5-60
220	AJ5-60
2,546	AJW5-70
100	A5-80
4,300	FA5-80
189	A5-90
981	J5-100
173	AJW-140
4,800	SF140
1,255	S5-200
16	SB5-225
6,758	S-295
23	GF5-300
900	S5A-300
180	S5-312
8,240	SR-325
109,170	S5A-325
2,630	GA5-375
24,834	AW6-40
162	FJ6-90
1,810	S6-250
41	S6A-275
85	S6A-312
158	S6-400
2,300	S6A-400
580	S6-425
3,645	S6A-375
1,175	S6A-400
11,618	S6A-425
11,115	S6A-425
129	FJ-1 2-10
5,790	FG-1 2-45
10,897	FAW6-1 2-45
22,664	FA6-1 2-45
17,443	AJ-1 2-50
53	AW6-1 2-50
158,478	FA6-1 2-55
640	A6-1 2-60
2,500	F6-1 2-60
1,710	FJG-1 2-60
20,335	FA6-1 2-65
6,650	F6-1 2-70
288,457	FA6-1 2-70
1,296	FJG-1 2-70
7,190	FA6-1 2-75
28	FJG-1 2-90
138	FJG-1 2-90
95,084	FJG-1 2-110
2,096	FJG-1 2-110
149	F6-1 2-120
1,645	FJG-1 2-120
48	FA6-1 2-150
260	F6-1 2-180
13,210	GF6-1 2-250 CN
1,600	GF6-1 2-312
40,350	GA6-1 2-375
21,160	GA6-1 2-375 CN
22,873	GA6-1 2-500 CN

RIVNUTS

Pieces	
20,920	6B45
2,405	AC845
15,830	6KB45
417	A6KB45
4,000	6-75
7,690	6B-75
55,854	6KB75
18,100	6B89
507,670	6-91
24,000	A6K91
3,742	6-100
129,700	6B100
12,040	6K100
800	A6K100
27,000	6-106
186	A6B106
25,000	AK B10
940	6K10
2,085	6-120
1,100	6B120
2,700	6B121
15,000	6K136
20,270	6-116
21,800	6-117
21,115	6-140
900	A6-140
33,500	6-B140
67,214	6K140
343,000	6-145
14,180	6B160
450	A6K16
390	6KB160
54,000	A6-161
1,905	A6B161
2,000	6KB161
185	6-180
742	A6K180
1,760	A6KB181
5,460	6-200
201	A6B-201
2,030	6-220
245	6KB221
800	A8B45
26,965	A8K45
213	A8KB45
1,500	A8-75
970	A8B75
1,570	8KB75
984	A8-100
1,250	A8B-100
5,900	A8K100
1,400	A8B106
513	A8K-106
357,887	8-120
5,700	8KB120
1,050	A8-136
1,000	A8K-136
55	8K-140
1,080	A8K-140
2,000	A8K-161
10,000	A8K-180
900	A10-45
820	A10-75
470	10KB75
68	S10K-75
1,610	S10MT75
60	A10-100
1,979	A10K-100
1,000	A10KB100
1,099	A10-106
1,030	10-106
11,500	A10KB106
14,910	10KB106
142,200	10-120
2,380	A10-120
6,000	S10-MR-130
13,370	S10-MR-160
3,960	10K161
100	A10K-B161
550	10-161
1,034	A10K-190
1,830	10K190
16,990	S10-MR-190
1,320	S10-MR-220
226	A10-221
200	A10B-221
460	A10K-221
640	S10-MR-280

LOCK SCREWS

Pieces		Pieces		Pieces		Pieces	
2,750	6480	96,500	6785-12	890	6815	320	6890
5,185	6481	210	6785-4	9,730	6815-3	1,406	6896
68,677	6482	420	6786	1,224	6820	2,890	6901
11,743	6483	176	6790	400	6843	23,763	6931
20,602	6484	125	6791	8,755	6860	37,160	6935
46,444	6761	1,966	6805	1,115	6861	37,786	6936
31,608	6762	2,100	6811-6	3,600	6862	1,930	6965
31,355	6763	25,000	6812	500	6866	5,045	6980B
120	6764	623	6815	2,500	6876	2,410	6981
773	6780	200	6815-4	2,000	6877	1,500	6981B
257,470	6781	7,250	6816	1,800	6878	7,400	6982
96,655	6782	2,582	6816-7	800	6879	8,786	6983
51,428	6783	26,100	6817	125	6881	1,694	6984
1,060	6785	3,580	6818	170	6882		

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Approaches—A Pilot's View

Several points recently were discussed here (AVIATION WEEK Sept. 13, p. 112) relative to an address by J. F. W. Mercer, "A Quantitative Study of Instrument Approach," before the Royal Aeronautical Society. There was considerable discussion at the meeting of the problems of directional stability in aircraft and the inevitable pros and cons of manual vs. automatic control on approach.

Mercer at one point concluded that "by the use of automatic equipment, approaches of the greatest accuracy would be obtained." It probably is true that a machine can react quicker to weaker signals and with greater accuracy than the human pilot. But this by no means ends the debate. Many operational factors must be considered.

▶ **Bressey Comments**—Some of these factors were brought out very nicely by Capt. Peter Bressey, British European Airways, who was present at the meeting. Insofar as space permits, here are some of his comments.

Capt. Bressey echoed the fact that the transition from instrument to visual flight is the most touchy part of the procedure and that three things must be considered: accuracy of the instrument approach; amount of required pilot concentration, and amount of mental strain on the pilot.

He pointed out that the third is different from the second. Second is concentration, while third is well termed "the pilot's tranquility of spirit," also referred to by certain irreverent copilots as "the captain's twitch factor."

What happens, for instance, when the automatic gear fails? Only through constant practice can the pilot cope with manual ILS approaches. And if aircraft use automatics, how does the pilot get that practice?

▶ **Minimum Approach**—Another rather practical consideration is the requirement that an airline pilot must prove his ability twice a year for license renewal. This means an ILS on partial power. How does the pilot get through his check if he has been sitting back on automatics for the past five and a half months?

Perhaps this is something for the pilot alone to worry about, but it isn't a happy state of affairs for anyone if he is out of practice on ILS and right in the middle of shooting a minimum approach finds his automatic gear not working.

Capt. Bressey further pointed out that if the approach is made easy enough, the pilot would be better off handling the aircraft manually all the way down. Among the needed changes is a replacement for the ILS cross-pointer, which simply doesn't provide good-enough information for use in large, fast aircraft.

▶ **Increased Speeds**—If some sort of flight director system (such as the Collins) were used, the pilot would be in the picture all the time and probably could do as good a job as an automatic approach.

In summation, Capt. Bressey said that aircraft are not getting any easier to handle on the approach and that speeds are going up continually. Not only is the pilot getting less time in which to sort things out, but he is being given a less responsive vehicle.

To all of these thoughts, I can only add, "Well done." They are indicative of some very real operational problems which should have the combined efforts of aviation people to solve.

Considering the importance of reliability in air transportation, it is unusual that the subject of instrument approaches receives so little attention.

AVIATION CALENDAR

Oct. 19-20—Seventh annual New York State Airport Development and Operation Conference, Syracuse, N. Y.

Oct. 21-23—American Society for Quality Control, eighth New England conference, Ten Eyck Hotel, Albany, N. Y.

Oct. 23—Airmail Pioneers, division reunion, VFW Club, Elmhurst, Ill.

Oct. 24-27—National Defense Transportation, ninth annual convention, including panel on Military and Civilian Use of Helicopters, Pittsburgh.

Oct. 27-29—National Business Aircraft Assn., seventh annual meeting and forum, Hotel Adolphus, Dallas.

Oct. 28-29—Aircraft Electrical Society, 11th annual display meeting, Pan Pacific Auditorium, Los Angeles.

Nov. 1-5—American Welding Society, fall meeting, Sherman Hotel, Chicago.

Nov. 2-19—The American University, eighth Air Transportation Institute, Washington D. C.

Nov. 4-5—American Helicopter Society, first Western Forum, Institute of the Aeronautical Sciences Building, Los Angeles.

Nov. 4-5—Airborne and Navigational Electronics, East Coast conference, Sheraton-Belvedere Hotel, Baltimore.

Nov. 8-9—National Aviation Trades Assn., annual convention and meeting, Biltmore Terrace Hotel, Miami Beach, Fla.

Nov. 8-9—National Air Taxi Conference, annual meeting, Biltmore-Terrace Hotel, Miami Beach, Fla.

Nov. 8-10—Air Industries & Transport Assn. of Canada, annual meeting, Chateau Frontenac, Quebec City.

Nov. 9-12—Air Line Pilots Assn., convention, Sheraton Hotel, Chicago.

Nov. 10-12—Industrial Management Society, 18th National Time and Motion Study and Management Clinic, Hotel Sherman, Chicago.

Nov. 11-12—Airmail Pioneers, division reunion, Hollywood Roosevelt Hotel, Los Angeles.

Nov. 12-13—National Symposium on Quality Control and Reliability in Electronics, Statler Hotel, New York.

Nov. 15-17—Aviation Distributors and Manufacturers Assn., 12th annual meeting, Mayflower Hotel, Washington, D. C.

Nov. 15-17—Magnesium Assn., 10th annual meeting, Hotel Chase, St. Louis.

Nov. 17-19—California Association of Airport Executives, semi-annual meeting, Sainte Claire Hotel, San Jose, Calif.

Nov. 18-19—American Society for Quality Control, ninth Midwest conference, Baker Hotel, Dallas.

Nov. 29-Dec. 3—American Society of Mechanical Engineers, Aviation Division, annual meeting, New York.

Nov. 30-Dec. 3—American Rocket Society, ninth annual meeting, Hotel McAlpin, New York.

Dec. 17—Wright Day Dinner, Statler Hotel, Washington, D. C.

Jan. 24-27—Plant Maintenance & Engineering Show, produced by Clapp & Poliak, Inc., International Amphitheatre, Chicago.

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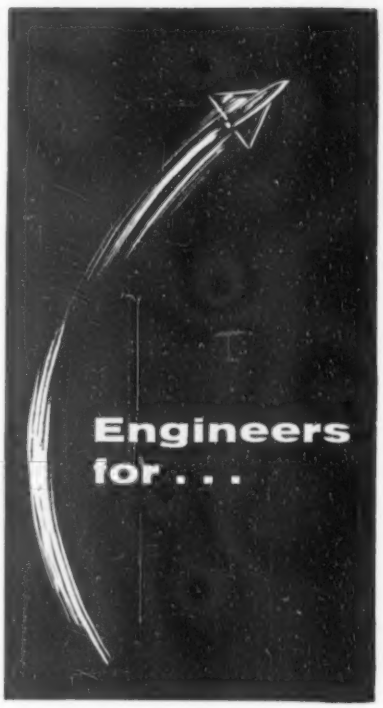

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EDITORIAL

Step Up the A-Plane

The lack of any powerful, overwhelming drive on the part of top government officials in developing an atomic-powered aircraft is one of the current mysteries of the Washington scene.

It is true that several statements in recent months did reinforce other reports that action may be stepped up to some extent, but there still is no evidence of anything like a crash program to tackle the problems still remaining. The present procedures seem almost casual. Range and flight endurance possibilities of atomic-powered aircraft, in addition to other advantages, appear impressive at this stage of development—certainly as important as similar advantages expected in the atom-powered submarine, one of which is already launched.

These comments are not to be interpreted as criticism of the various firms holding rather small contracts from the Air Force or the Atomic Energy Commission. Obviously, government must stipulate the terms and rate of work under its own contracts.

Nor can we charge off the slow pace to official pessimism in Washington. Several sources recently, including USAF Chief of Staff Twining, have hinted that the progress being made is promising.

Our contention, based on the grave importance of achieving, maintaining, and increasing our superiority over Russian aviation, is that progress would be faster with a vastly stepped-up pace for the A-plane project in our research and development program.

'Nothing Is Perfect'

A writer who happens also to pilot aircraft for a living wrote a manufacturer the other day and the message deserves mention on the editorial page of a magazine that believes in a similar philosophy.

The letter was written after publication of some comments about the company's products that could, conceivably, be interpreted as destructive criticism by those who like no criticism at all.

"It always amazes me," the pilot wrote, "to find that there are people who feel that criticism is an attempt to tear down—to sling mud. It should be apparent that an organization such as yours exists because of the fine products it turns out, and the same is true of most companies. At the same time, nothing is perfect, and if no attempt is made to point out imperfections, then stagnation sets in.

"If I did not feel that your products, or the airplane I fly, or a thousand other items were reliable, I would not fly. Conversely, I recognize the limits of reliability. It's a fairly difficult proposition to imagine that everything is ginger, peachy and keen when gadgets have gone haywire on your own airplane right before your eyes. If there are people who believe these episodes must be hushed up, they have another think coming."

Criticism can be and should be constructive. Publicity of constructive criticism is one of the obligations of any conscientious publication.

Policy Molder or Errand Boy?

Is the top public relations man in your company a policy maker who sits in on management meetings, or an errand boy? Or something in between?

One company formerly considered its public relations activities as a by-product of its sales department. Those who directed sales also directed public relations. Sales-directed public relations frequently are lopsided, perhaps unduly promotional on one hand and unwilling to face up to unpleasant problems until the roof falls in.

Now, however, public relations in this company is the domain of the president's office. That is because the chief executive recognizes the importance of adroit, yet sound and intelligent, public relations. The head of public relations is also assistant to the president. He is a former newspaperman. He sits in on all high-level meetings, regardless of subject, and is familiar with the press and publicity.

Obviously, this high-level position affords that man a comprehensive view of the most important company problems, policies and activities, in all departments, and this view is always up to date.

Such a policy will not work without the right man in the job, but the value of effective public relations is rising, and justifies care in finding him.

Some company officials seem to complain about almost everything in their public relations except their own outmoded concepts of this important subject.

Research & Executive Planes

Interest continues to rise in the potential market in the U. S. for new executive aircraft types.

Significantly, British concerns too are casting fond glances in this direction.

Each new generation of airliners outdoes a bit more the best cruising speeds of the fastest executive aircraft. Faster executive or business planes are coming. But most manufacturers are unwilling to take the financial plunge without orders on the books. There are few orders on the books, and manufacturers complain that there is insufficient agreement among potential buyers as to what they want. Those who know what they want too frequently are unwilling to pay the price manufacturers set in preliminary estimates.

Sound market research appears to be one of the best answers, but there is surprisingly little of this under way. In a few instances, firms have gone ahead on prototypes whose specifications and dimensions appear to be dictated by internal company conditions or ideas that have very little to do with requirements of the market. Or, after work has started, research has been launched to justify the specifications.

The risk that such projects present is unnecessary, because they are far more likely to result in failure than to strike the peculiar combination of buyer fancies.

Sound market research before the project ever starts—not afterward—is good business. And from early appearances research is likely to dredge up some unexpected facts about this promising market. —Robert H. Wood

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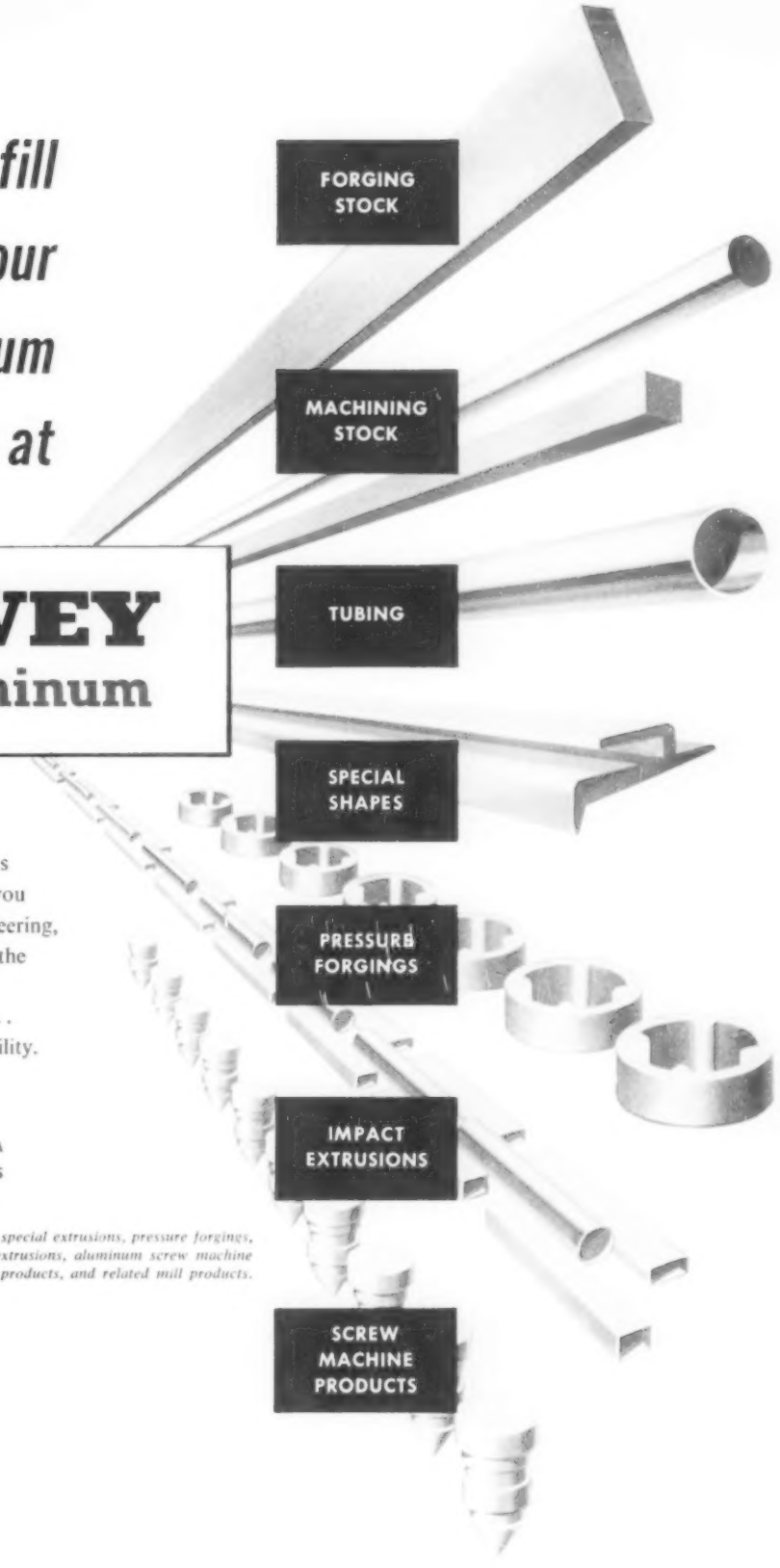

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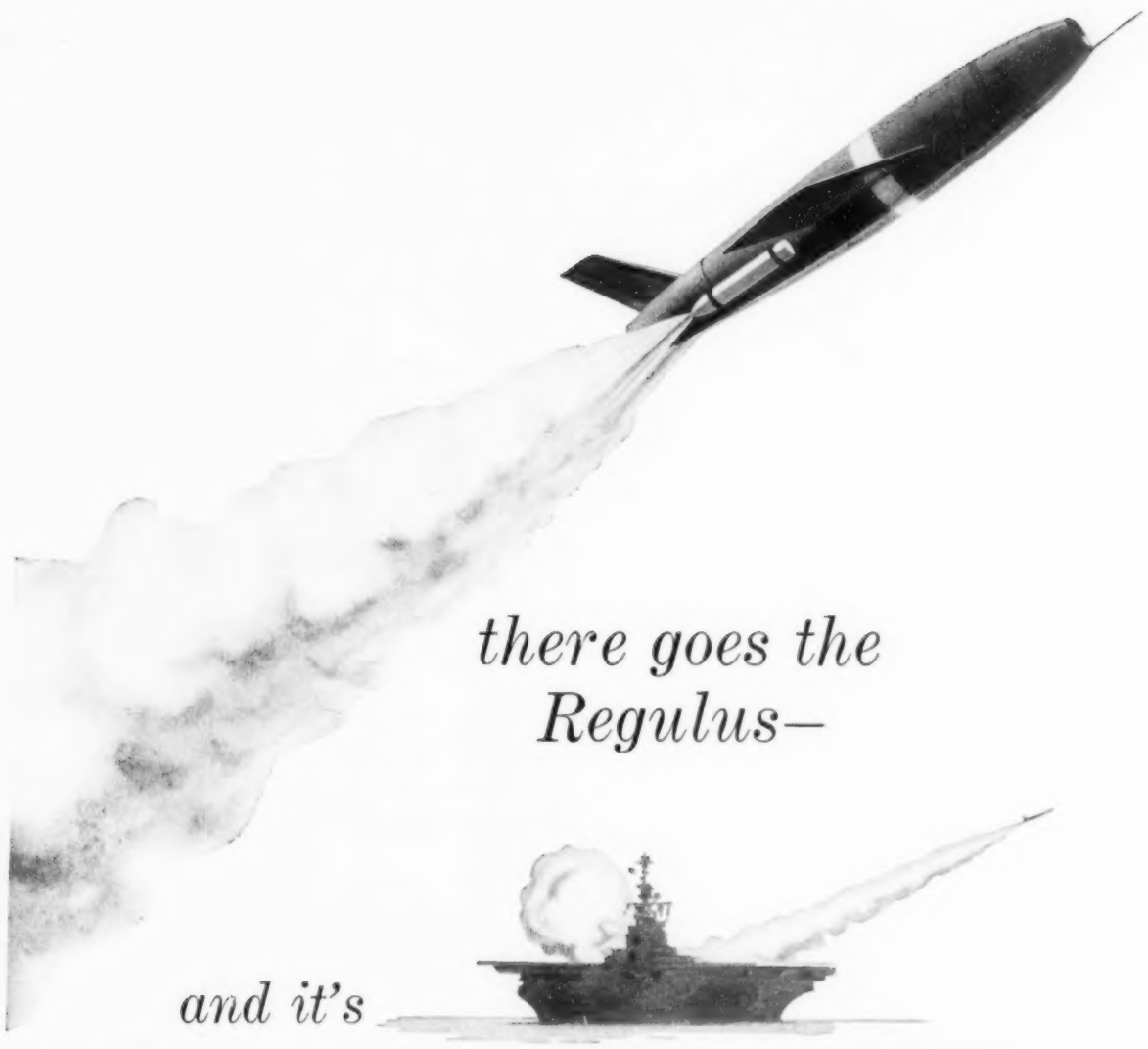

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